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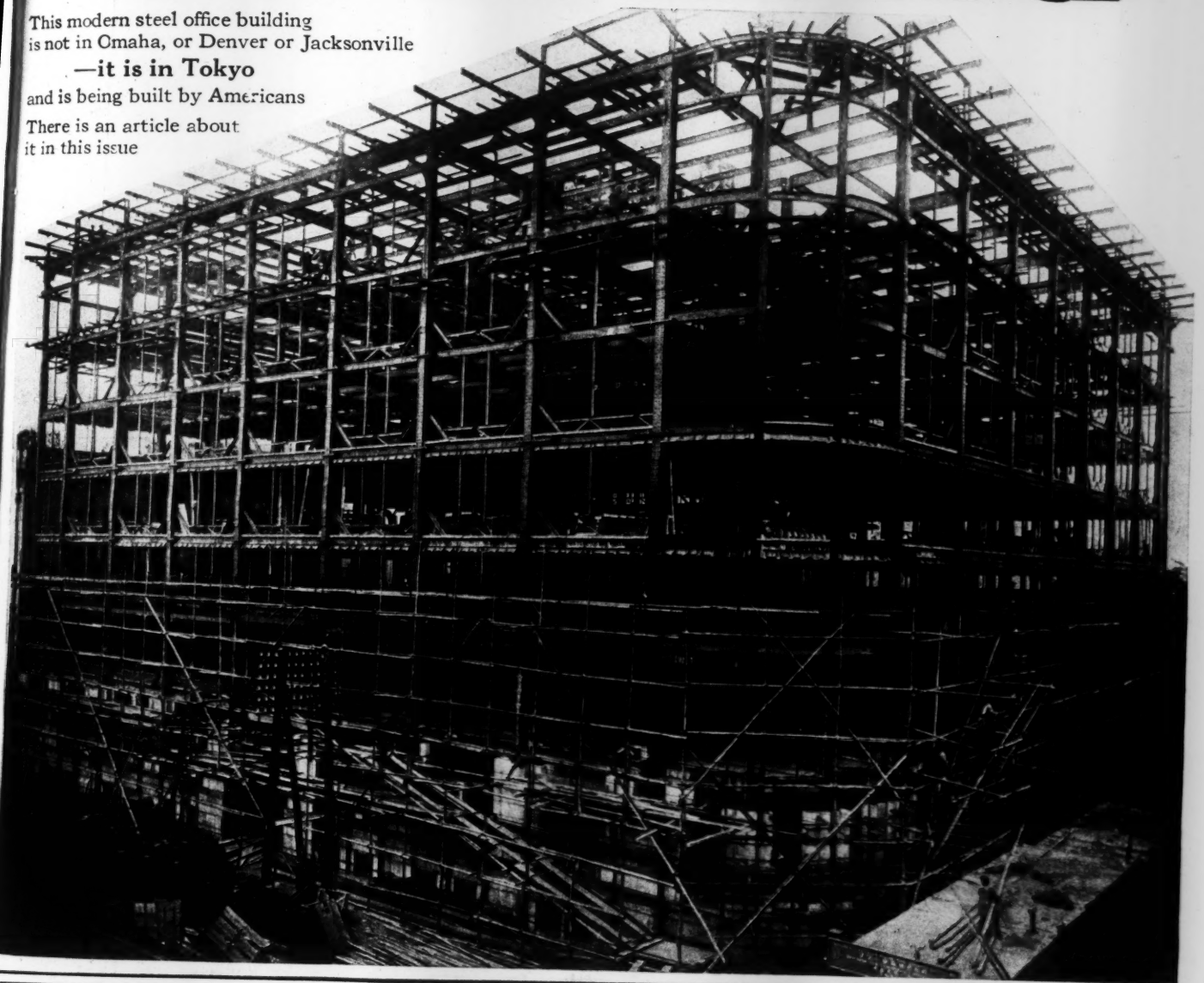
September 21, 1922

Engineering News-Record

This modern steel office building
is not in Omaha, or Denver or Jacksonville
—it is in Tokyo
and is being built by Americans
There is an article about
it in this issue



I. The Causes
- Winter Idleness
- Rain and Mud Delays
- Plant Delays
- Service Delays
- Inefficiency

II. Winter Idleness
- Governing Conditions
- Statement of Problem
- Heavy Excavation
- Road Building
- Municipal Work
- The Cost
- Remedies

Coming—

"Lost Time In Construction"

A Series of Four Exceptional Articles Analyzing Causes and Suggesting Remedies. The first will appear in

Engineering News-Record

October 5

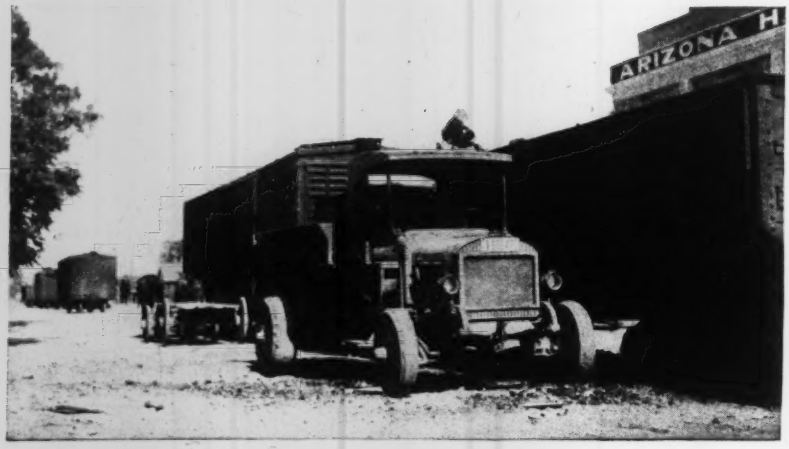
"Methods of utilizing time worked on construction contracts have had intensive study, but methods of finding MORE TIME for work have been ignored."

For Contractor, Engineer and Manufacturer

III. Rain and Mud Delays
- Earth Moving
- Road Building
- The Cost
- Remedies

IV. Management Delays
- Plant Delays
- Service Delays
- Labor Delays
- Direction Delays
- Remedies

General Motors Trucks



One of the GMC Trucks Used By Hemperley Cantracting Company of Phoenix, Arizona.

Finds GMC Trucks Give Most Economical Service

"I operate a fleet of five heavy duty trucks regularly on road building and street paving work. Two of the five are GMCs. I do not hesitate to say that the GMCs give me much more economical service than any of the others."

This is the answer of Mr. Hemperley, of the Hemperley Construction Company, Phoenix, Arizona, when asked as to the type of service he was receiving from his 1920 model, 5-ton trucks. Mr. Hemperley is one of the foremost road building contractors in the southwest and has an established reputation for keenness in selecting materials and equipment which will give the greatest service for the least cost.

"Road building in any section of the country requires good equipment if the contractor expects to reap any profit from his work," says Mr. Hemperley, "but merely good equipment is not sufficient in this portion of the southwest. The contractor simply has to have the *best* equipment he can get, for conditions have to be met here that are not found elsewhere.

Wishes Had Only GMC Trucks

"While I have only two GMC trucks, as against three of other makes, it is only fair to say that the GMCs are my last addition to the fleet. A man gains experience as he grows older, and it is probable that all of my fleet would have been GMC had I known as much about trucks when I bought my first one as I do now.

"Road building in Arizona presents many problems not found in other sections. The desert stretches give many difficulties in transporting the road materia's, for the trucks have to travel plowed, loose, soft ground that piles in front of the wheels and gives hardly any traction. In the mountain sections we are often confronted with the necessity of cutting temporary roads close to the line of the highway in order to get the materials to different camps along the way. If this were not done, some of the mountain roads would take decades to construct. An example of this is the new highway from Superior to Miami. This road, which is one of the finest pieces of engineering in the country, was built through a rugged mountain country, a distance of more than thirty miles, in less than two years. Had the temporary road plan not been worked so that several camps could be located at different sections at the same time, this road would have taken from ten to fifteen years to construct.

Must Have Reliable Units

"I mention these things merely by way of pointing out that the trucks do not have any easy sledding. Temporary roads are mighty poor at their best and heavily loaded construction trucks have to be mighty well built to stand up under the grind.

"Of course everyone knows that most contracts have a time clause in them—these time clauses mean real grief and serious losses to the contractor unless he can live up to them. That is one of the principal reasons the contractor has to have the best equipment he can get. If his trucks fail him he cannot haul his material, and if he can't haul his material he certainly can't build roads.

"I think I have been in the business long enough to know how to figure costs pretty accurately and when I say that GMC trucks are giving me more economical service than any other, I am saying just about all I can, as any contractor will quickly recognize."

GMC trucks are economical in first cost, too. Their chassis list prices, at the factory and plus the tax, are: one ton, $1295.00; two-ton, $2375.00; three and one-half ton, $3600.00; five-ton, $3950.00.

GENERAL MOTORS TRUCK COMPANY

Division of General Motors Corporation

PONTIAC, MICHIGAN

Dealers and Service in Most Communities

A Consolidation of Engineering News and Engineering Record — McGraw-Hill Company, Inc.—JAMES H. McGRAW, President

ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

E. J. MEHREN, Editor

Volume 89 — NEW YORK, SEPTEMBER 21, 1922 — Number 12

Early Settlement Not Likely

IT APPEARS that the hope for an early settlement of the railroad shopmen's strike on the roads that signed the Baltimore agreement for separate settlements is not to be realized. And yet could we have expected that the negotiations for separate agreements would have been quickly and amicably terminated? The Baltimore arrangement, originated by S. Davies Warfield and Daniel Willard, did not settle the real stumbling block in the earlier negotiations, the seniority issue, but relegated it to conferences between the individual roads and their employees. To have expected that this important issue could be easily compromised was hoping too much. Within a week of the settlement, the New York Central broke off conferences with its employees, while strikers returning to the shops of the Chicago, Milwaukee & St. Paul and the Chicago & Northwestern railways at Chicago immediately got into conflict with the officials over the status of the returning men. On the other hand, several roads report the conclusion of arrangements with their men, but the details, particularly on the seniority issue, have not been disclosed. It is apparent, however, that the shopmen's strike is on its last legs. The strikers have been steadily losing. Here and there, they may regain their seniority standing but, by and large, their fight has been lost. From their standpoint, the greatest blow has been the abandonment of their insistence upon a national settlement. Their solidarity has been broken by their agreement to accept individual negotiations.

The Train-Crew Brotherhoods

WHILE the difficulty with the shopmen is not being easily composed, there is ground for gratification at the favorable progress of negotiations between the train-crew brotherhoods and several of the railroads, looking to agreements on working rules and wages for the next year. It is announced that the arrangements have been successfully concluded in this regard by the New York Central, Pennsylvania and Lehigh Valley systems. After all, the train-crew brotherhoods hold the key positions in railroading. If amicable settlements are secured with them, the continuance of uninterrupted railroad service is assured.

The Sounder Course

UPON the conclusion of the new agreement between the train-crew brotherhoods and the New York Central, W. G. Lee, president of the trainmen's organization, declared that in "going backward" to direct negotiations between railroad executives and railroad employees, without the intervention of the government thorugh the Railroad Labor Board or otherwise, the railway industry was getting on a sounder basis. For twenty-five years, he declared, the brotherhoods had successfully done business with the railroad executives direct and that that method was the only way in which peace could be maintained. He recommended the settlement of the affairs of the workers without any meddling by politicians. This is indeed a return to a sounder course and we are particularly glad that Mr. Lee himself is among the converts. If our recollection is right, he is one of the four men who rocked themselves complacently on the portico of the Capitol, while, with the aid of President Wilson, they were holding up Congress and the country in 1916 over the eight-hour law. If Mr. Lee means all he said in his pronouncements at New York last week the conversion is a notable one.

An Evil and a Remedy

IT HAS been evident for some years that we are confronted by a steadily increasing hazard arising from the combination of thousands of old, weak bridges on the roads of the country with rapid expansion of heavy motor-vehicle traffic. The evil of the situation has become pretty generally recognized, however reluctantly. But little or nothing has been done toward remedying the evil. The defective bridges are chiefly in township and county control. Located on side roads they were built for purely local needs and have never been made part of the state highway systems. Statewide traffic needs have invaded the local roads, however, and many of the old bridges have run down, in the hands of haphazard local government. Two failures reported in this issue, one from Oklahoma and one from Georgia, illustrate the part played by these circumstances. To replace or strengthen all of old bridges within a short period is quite out of the question for financial reasons, especially as it is the commonwealth whose traffic demands create the danger and the local communities are therefore unwilling to pay for the work. The only remaining way to limit the danger is to issue clear warning of weakness of each bridge by posting its capacity. This can be done quickly and at little cost. Posting is not an absolute protection, and S. B. Slack, of the Georgia highway department, goes so far as to call the Satilla River collapse an illustration of its inefficiency. But the argument of this one accident is not convincing. Though a bridge warning, like a railway block signal, can be disregarded, in either case the one who disregards it courts almost certain destruction. Block signaling gives us dependable protection of railway traffic, and the posting of highway bridges will reduce, if it does not virtually eliminate, the present bridge hazard.

State Control Desirable

LITTLE good can be expected from attempts to deal locally with a condition arising from a statewide cause, one which in each case is largely foreign to the locality affected. So long as the local highway bridge carried chiefly the traffic of the neighborhood its care was properly reposed in the local government. But under the conditions of today it can not be expected that local authorities will be diligent in building and maintaining bridges to the standard demanded by statewide traffic. The responsibility should now be placed

wholly on the state government. Specifically, every highway bridge in the state should be taken over by the state, and its control, safe maintenance and reconstruction be made the business of the state authorities. It may be said against this proposal that bridges are integral parts of the road, and that they must therefore remain in local control until the state can take over the entire road system. But this objection cannot be sustained, we believe. A local road remains of local interest until the volume of through traffic becomes so great as to make it a thoroughfare, the natural charge of the state; the question is one of character and density of traffic. With the bridge the traffic density is not determining; the maximum load, which is the critical factor, depends on the general highway "business" of the state, independent of local factors. Even though roads remain matters of local administration, bridges are the concern of the state, and their safety calls for state control and state responsibility.

Too Early to Standardize

IN HIS review of railroad electrification, published in last week's issue of *Engineering News-Record*, Mr. Gibbs has emphasized the danger of premature standardization. Mere inspection of the various diagrams of motor arrangement and locomotive designs that accompany his review will demonstrate the truth of his statement that no approximation even to a standard electric-locomotive design has been reached Although the field in this country seems to be narrowing to the use of two systems, that is, the 3,000-volt direct current and the 11,000-volt single-phase alternating current, Mr. Gibbs believes that it is too early to fix as standard any one system, much less to exclude from consideration any system that offers promise. It is true that European practice is tending toward a higher degree of standardization than is our own. The Italians cling to the three-phase system, the Swiss are strongly committed to the single-phase system, while the French and Belgians pin their faith to direct current at 1,500 volts. The British are definitely committed to the 1,500-volt direct current system. But conditions in Europe are so different from our own that standardization may be possible there long before it should be thought of here. Certainly any premature commitment that will obstruct the development of the art may delay the day when electricity will play its full part in the solution of our railroad problems.

New Angles to Old Problems

MR. GIBBS' suggestion that axle weights may have been carried beyond advisable limits in steam locomotives and that in the design of electric locomotives thought should be bent toward a return to lighter loads will strike a responsive chord among railroad bridge engineers. During the recent discussion in the American Society of Civil Engineers on Mr. Steinman's proposed standard bridge loading, reference was made to the possibility of electric traction helping to counteract the present tendency toward heavier and heavier bridge loadings, and to the reduction of impact stresses that may be expected because of the use of electric locomotives. The development of heavy electric traction will develop so many new angles that the railroad engineer in every department can ill afford to lose touch with developments in that field, which, as normal business conditions are restored, seems destined to assume a greater and greater importance.

Maintenance Guarantee Clauses in Highway Contracts

IN THIS time and day few state highway departments stultify their engineers and increase the hazards of their contractors by including a maintenance requirement in their contracts. It is true that occasionally a state specification requires defects, which may occur in a newly built road within twelve months following construction, to be repaired by the contractor, but none has any requirement corresponding to the long-time maintenance-guarantee clause which was of notorious reputation among contractors a decade ago in city paving work.

This is all true of state road work and the rural road contractor has been congratulating himself accordingly, but it is not true of country road work in many counties in numerous states and the contractor is wondering what it signifies in the way of increased hazard. The question is well worth consideration.

County requirements for road maintenance by the builder are partly a hang-over from city paving practice and partly a resort to escape the task and expense of establishing a county highway maintenance organization. It is a way of "beating the devil around the bush" in the matter of road maintenance expenditures which appeals to inexperienced county commissioners because no figures of maintenance cost show up in the annual budget. Obviously the costs exist and it is more than probable too that they represent more than the actual maintenance expenditures by the amount which the contractor has added for risk.

If the county reaps no benefit, then no one does, for the contractor always chances a loss in undertaking a long-term maintenance guarantee. No contractor desires to undertake maintenance as a part of his construction obligation. He does so only because he must. He invariably charges for the service and if on occasion he in error charges too little and the county benefits in that instance, still in the long run the people pay all the cost. The contractor charges for guaranteeing road maintenance and he must make his charge high because he is guaranteeing not merely sound construction and pure maintenance, but also that the engineers have designed the road properly, that they have anticipated correctly the amount of traffic it will receive and that the traffic loads will be regulated.

This is not a theoretical hazard. In frequent instances when a paved road has been completed latent traffic has developed and traffic has diverted to the new good route from older alternate routes. Instances are on record where the traffic has doubled in a few months the volume anticipated for several years. The contractor of whom a maintenance guarantee is required absolutely must for his own protection assume a rate of traffic increase which gives him a reasonable margin of safety. In the most favorable circumstances he is required to add to his estimates an item regarding the value of which his normal construction experience gives him little information.

Obviously some action is required by state and federal highway officials to have counties and minor municipalities conform to state and federal practice which eliminates maintenance guarantee clauses from construction contracts. The practice is economically unsound and is seldom highly effective in getting good maintenance and it never gets uniform maintenance. That it continues is a clear indication that state high-

way departments have not been alert to one of their most promising activities. This is the duty of educating the road officials of small municipalities and the public generally in sound principles of public roads management.

An Unfinished Job

THE American people have been grappling for a long time with the problem of how to protect themselves against two evils. One of these is extortion by monopoly; the other, exploitation by both parties to industrial disputes. Although we are accustomed to think of these as being two distinct problems, as here set down, they are in reality very closely related.

We have made progress. Today, public service corporations are so closely regulated that in some cases they need almost to be protected against extortion at the hands of the public. Capital in general has been deprived of much liberty of action, especially with regard to combinations that might effect restraint of trade to the public hurt. But so far as public utilities and the necessities are concerned, we have only half finished the job. We may have guarded ourselves against the weapon of monopoly in the hands of management or capital, but we are still at its mercy in the hands of labor.

Let there be no mistake as to who is the victim of this weapon. When the necessities are concerned, it is not the employer. It is the public, precisely as when the weapon is wielded by capital. Probably, in view of the experience through which we are now passing, it is unnecessary to dwell upon this point. Before we are through, it will be clear to all of us that in such cases capital becomes but a collection agency for labor. Indeed, there are those who intimate that some of the coal operators have done what they could to extend the monopoly of labor into fields not yet under its sway, and thereby achieve a monopoly for the industry through its unrestrained and unregulated element. And it is not beyond the realm of possibility that one of the operators' grievances against the miners' organization is its failure to turn the trick.

Having set a guard over the one gate, we now face the problem of securing the other. But here we seem to run into a snag. Under no conditions, we are told, must we interfere with "collective bargaining." This is the first obstruction. Then, we are warned, we never should think of restricting "the right to strike." And finally we must abandon any idea of imposing "compulsory arbitration" of disputes. Obviously, these restrictions tie us up completely.

Let us examine the process of our undoing. By virtue of "collective bargaining" the labor engaged in an essential industry, let us say, combines on a national scale to impose its will upon the industry. In other words, it organizes a monopoly of labor, one of the essentials of industry. Its demands take the form, we will assume, of either higher wages or lower output. But capital, another essential of industry, says: "Nothing doing, we won't pay any such wages or consent to any such restriction of output."

"Very well," says labor, "then we'll quit."

And it does.

Just about now the public wakes up. The supply of a necessity has been stopped. Production must be resumed; so it urges the contending parties to arbitrate their differences.

"Oh, no," says labor, "nothing doing; I might lose."

"Well, then," threatens the public, "we'll make you arbitrate, just as folks do in other disputes."

"You cannot do it," returns labor, "for that would be 'compulsory arbitration' and would deprive me of the 'right to strike,' which you must understand is sacred. Furthermore, Mr. Public, you may as well remember that I am irresponsible and cannot be reached under the law."

And just about there the public surrenders abjectly, bluffed to a standstill. Seeing the turn affairs have taken, the employers now meet labor's demands, jack up the prices of their products, and the public pays. Here, we are, still victims of monopoly control over the necessities, just because we lack the sense or the courage to follow our principles through to a conclusion. Summed up in a sentence, the moral of this tale is simply this: *So long as one essential element of an industry can be monopolized, the industry can be monopolized.*

Now just what is there to these potent shibboleths, "collective bargaining," "the right to strike," and "compulsory arbitration"? The first is the device by which employees seek to overcome the economic advantage usually enjoyed by the employer. So used, no one would question that it is thoroughly legitimate. But when this device is perverted into a national monopoly to be aimed through all the employers in an industry against the public welfare, we see no reason why it should be tolerated any longer than would be the collective bargaining of the manufacturers in that same industry when similarly aimed. The "right to strike" is perfectly understandable and legitimate when applied to the individual. No man should be compelled against his will to work for the profit of another. In public service, however, the surrender of such a right may well be a condition of employment; and in many cases it actually is. But even in private employment at an essential industry, when the abstention from work is not the act of an individual performed for his personal interest or gratification, but the result of a widespread agreement or conspiracy to create public hardship, it is not easy to see wherein such a practice should be less subject to public regulation than is similar conspiracy in restraint of trade on the part of employers. All this applies with equal force to "compulsory arbitration." When used to justify the industrial disturbances through which we are now passing, these principles are grossly perverted; and in the public interest their application should no longer be exempt from legal restraint.

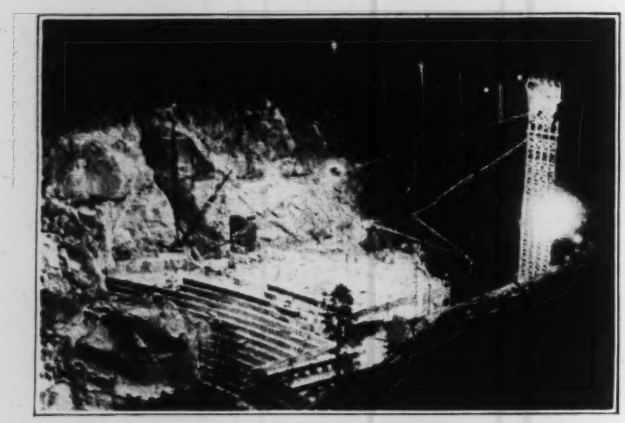
From all this it is a fair conclusion that we never shall enjoy industrial peace and security until we apply to all the elements of industry the restraint we have applied to some of them. We never shall dispense industrial justice until our laws are framed and interpreted in the public interest without regard to whether they affect the wages of current labor or the wages of thrift, commonly known as interest or dividends. Little is needed of additional legislation. All that is needed is the incorporated and responsible labor organization, equally amenable with capital to the laws in restraint of monopoly and anti-social conspiracy. Not more law; but a striking of the shackles from the law we have. And above all else, mental honesty and moral courage.

Plant and Program on the Hetch Hetchy Dam

Average Production 1,600 Cu.Yd. of Concrete Per 16-Hour Day—Bulk Cement Handling Successful—Materials Plant Rearranged as Conditions Change

VERY satisfactory progress is being made in the construction of the Hetch Hetchy Dam which is a part of the new water and power project being carried out by the City of San Francisco. About 500 men are working at the dam site, in material yards, camps and on the dam itself. An average of 100 cu.yd. of concrete is being poured per hour during the usual 16-hour day and in the month of May, working 53 out of a possible 62 shifts, 41,178 cu.yd. were placed. On Sept. 1 about 295,000 cu.yd. had been placed in the structure.

In addition to being of interest because of its size and height (the present contract calls for placing 365,000 cu.yd. of concrete and will carry the structure to a height of 344 ft.) some of the construction features of interest are the use of bulk cement, the success



GENERAL VIEW OF DAM AS LIGHTED FOR NIGHT SHIFT

in developing porous concrete blocks for drainage wells, the use of a 350-ft. concrete tower for the spouting system, an effective system of aligning forms and the method of concreting around large valves to prevent forcing them out of shape. The first concrete was poured in August, 1921, and despite some delay due to power shortage, it is expected that the work will be finished by the end of this year. An article on preparing foundations for the Hetch Hetchy Dam appeared in *Engineering News-Record*, Aug. 11, 1921, p. 222.

The dam is of the gravity type, curved in plan on a radius of 700 ft. and has a maximum cross-section as shown in the drawing on p. 466. The portion shown by solid lines is the part now being constructed; the dotted lines indicate the proposed future increase in height. The siphon spillways shown in the cross-section are to be filled with concrete when the height of the dam is increased. In addition to the 23 x 25-ft. tunnel used as a bypass during construction in which three 36-in. needle valves will be installed, other outlets will consist of four batteries of conduits arranged at different levels, three sets of two 5 ft. in diameter and one set of three 3½ ft. in diameter. All of these will be controlled by balanced needle valves.

During the low-water season the three 3-ft. balanced needle valves are to be put in the bypass tunnel. As a precaution to aid in effecting closure of the dam in case of an unusually wet season next year, a 12-ft. opening of horseshoe shape was left through the middle of the dam at the same level as the bypass tunnel, i.e., just above the level where the full width of the foundation was discontinued. After it has served its purpose this opening is designed to be closed by stop logs on the upper face of the dam while the concrete plug is being placed.

The materials handling plant is located on a slight eminence in the reservoir about half a mile above the dam. This was the most convenient place where sufficient room was available and it was planned to crush there the rock hauled from a pit about 1½ miles farther up the reservoir and to wash fines from the gravel accompanying the rock. Several new factors have entered since beginning work which have required rearranging the plant. For example, after some experiment the material accompanying the rock was rejected and the railroad was continued to a sandpit about 2½ miles farther up on the floor of the reservoir. Thus material from the rock pit is washed and the washings are wasted. Sand from the new sandpit is passed through a screening plant recently added and is stored in a separate stockpile, while the reject goes in with the product of the primary crusher.

Delay due to breaking the single primary rock crusher which was first installed led to the installation of a second crusher that was used until repairs could be made on the broken unit and since then has been kept ready for similar emergencies. The first primary crusher is of the gyratory type, while the reserve unit is of the jaw type. Both are set to pass 4-in. rock and each has a capacity of 200 cu.yd. per hour which is sufficient to keep the mixer plant running at capacity.

The rock is washed once in the rotary screen above the secondary crushers. There are two of these of equal capacity set to clear 2½-in. rock. Neither is large enough to keep the mixer plant operating at full capacity, but by keeping a considerable rock storage ahead, minor repairs can be made without delaying the work.

A stratum of very fine sand that came from the sandpits caked by moisture, rolled up in lumps in the perforated metal screen and passed out with the reject. This was a decided loss as fines were urgently needed. The difficulty was entirely remedied by substituting wire mesh for the perforated metal screens. Crusher dust is screened dry so as to avoid the loss of fines, and everything passing the ¼-in. screen goes into the sand pile.

As an afterthought it has been made possible to store a supply of gravel between ¼-in. and 1-in. size which is very convenient for concrete used in screen racks or wherever gravel serves better than crushed rock. This material is secured by placing an inclined screen with 1-in. perforations in the chute conveying the reject from the ¼-in. sand screen to the rock crushers.

The original plan was to have all materials in one large stockpile, the sand at one end and crushed rock at the other. Since the addition of the separate sand storage pile, only a small amount of sand storage is

maintained at one end of the rock pile. The capacity of rock storage is about 8,000 cu.yd. and the total sand storage is about 5,000 cu.yd. In loading the 12-car trains of 4-cu.yd. dump cars the train first backs under the sand pile and when the sand cars have been loaded the train is moved under the rock storage for the remainder of its load.

At the mixer plant these trains dump into receiving hoppers whence the material is elevated by belt conveyors to a 3-bin bunker. Each bin has a capacity of 250 cu.yd., the center one being used for sand and the two outer bins for rock. This plan makes possible the convenient arrangement of chutes direct from sand and gravel bins to each mixer.

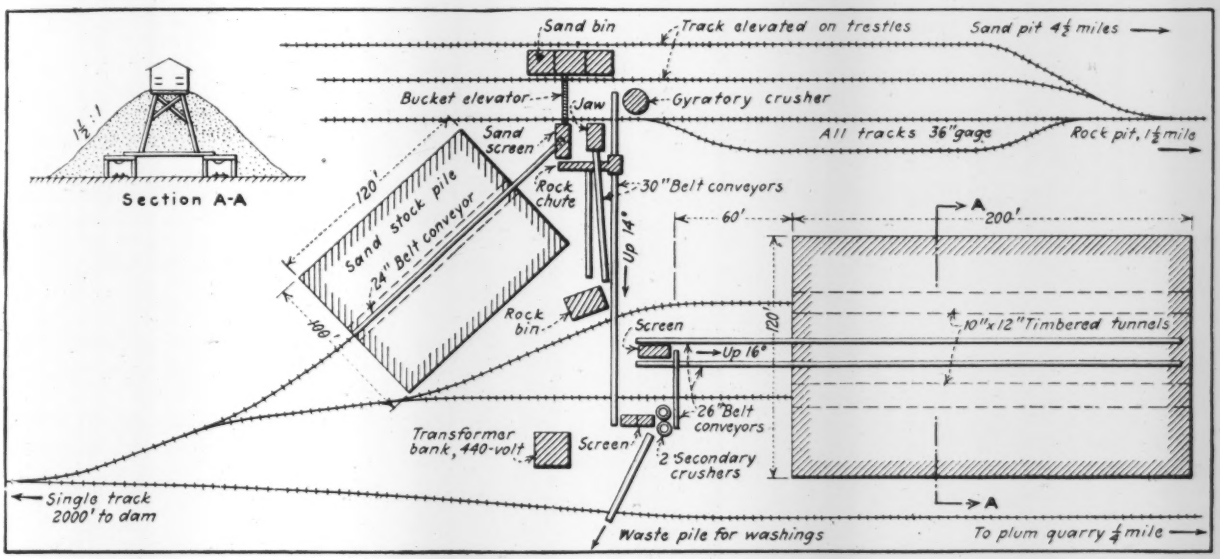
The plant for handling cement in bulk which was described in *Engineering News-Record*, March 2, 1922, p. 352. continues to be very satisfactory. Each charge of cement is still weighed by hand as the automatic feature was not considered dependable. However, with an operator on each machine there has been no difficulty in delivering batches at an average interval of two minutes. With the proportions now used the richer mix takes 960 lb. of cement per batch and the leaner mix 799 lb. per batch.

There was some difficulty in getting this quantity of cement into the weighing compartment without delay and this was overcome by putting a ½-in. air pipe into the cement hopper just above the radial gate and directing its nozzle upward. By turning on the air when the hopper gate is open any tendency to arch or clog is prevented.

White, red or green signal lights are burned continuously on the weighing house to indicate to workmen on other parts of the job whether the rich or the lean mix is being delivered; red indicating for one scale, and green for the other. The same plan is followed at the head of the spouting system so the foreman on the dam knows when to change the point of delivery. A 1:3:6 mix is used in the body of the dam and a 1:2½:5 mixture is placed in the 5 ft. next to the upstream face, along the downstream face of the spillway and at certain other designated sections.

The cement from the measuring room is delivered to concrete mixers through two 8-in. steel pipes which drop the cement about 180 ft. on a 1 to 1 slope. During cold weather when hot water was used for mixing concrete steam rising in these cement pipes had a tendendy to cause clogging. There was also the entrance of some rainwater at pipe joints. The joints were tarred to make them watertight and 8-in. vent pipes about 30 ft. long and curved downward at the upper ends were put into the receiving hoppers at the foot of the cement pipe to prevent the accumulation of pressure and to serve as a vent for water vapor. No pouring was done during zero weather. Cold weather limit was fixed at 20 deg. on a rising thermometer.

The mixing plant consists of two 2-cu.yd. batch mixers driven by 50-hp. motors and which ordinarily turn out 100 cu.yd. of concrete per hour. The maximum pour of 2,000 cu.yd. has been attained in a 16-hour run. The mixer operator manipulates all levers controlling the admission of materials into the mixer. With the exception of the water valve, all these gates are operated by water pressure. The sand and gravel measuring hoppers are located close to the outlet from the bin above so that when the measuring hopper is full it automatically chokes and the radial gate from the bin above can be closed at any time before the outlet from the measuring box is opened again.

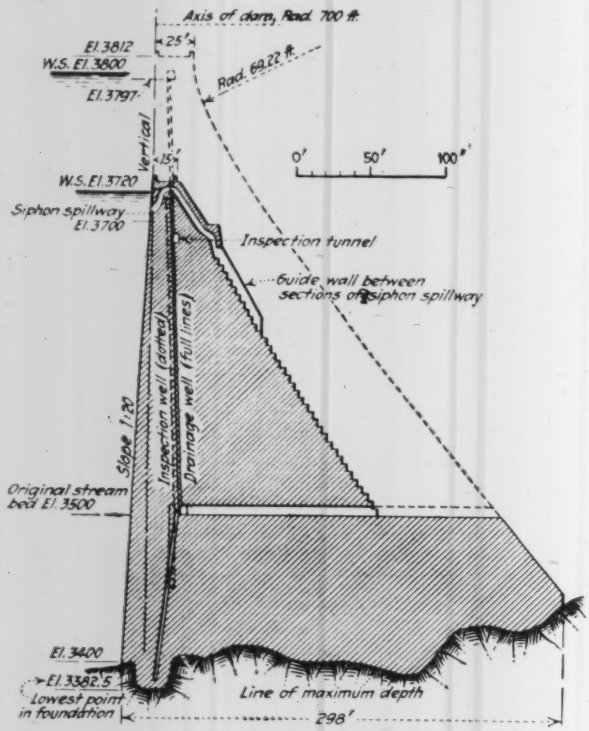


ARRANGEMENT OF EQUIPMENT IN MATERIALS PLANT AT HETCH HETCHY DAM

Each batch is mixed a full minute. Charging and discharging occupy about another minute, so that normally a batch is delivered once every two minutes.

Each mixer discharges through a hopper that delivers to either of two skips which in turn deliver to a hopper which is changed to various levels in the tower at the head of the chute system as the work progresses. At this point a hopper capacity of about two batches has been found convenient in regulating the flow through the chute, in avoiding stoppages and maintaining continuous delivery. A separate chute system is used for each mixer, but the capacity of each chute is sufficient to take the output from both mixers whenever there is occasion for concentrating this delivery.

The surface of the dam on which concrete is being



MAXIMUM CROSS-SECTION OF HETCH HETCHY DAM
Cross-hatched portion being built under present contract

poured is kept higher at the downstream edge than at the upstream edge, giving the concrete a downward slope of about 10 deg. toward the upstream face of the dam. This facilitates hosing off the surface by affording a good slope for drainage and it also eliminates the possibility of any weakness due to existence of construction joints in a horizontal plane or sloping downstream. In addition to this slope of the working surface, risers or vertical steps 5 ft. high parallel to the axis of the dam are occasionally put in to break the uniformity of the slope. This is accomplished by pouring concrete against a longitudinal run of forms which are removed before the next section is poured.

Before pouring concrete on the sloping top of the dam the surface of the previous pour is brushed with wire brushes and thoroughly hosed with water from a 1½-in. hose under a head of 300 ft. This phase of the work involves considerable time as concrete is poured, at maximum section, on an area of about one acre which has to be entirely gone over every six or seven days. In addition to washing and brushing, all surfaces against which fresh concrete is poured are thoroughly wet down just before pouring. During the winter months this calls for minor attention but the hot dry winds of summer greatly increase the hosing.

The standard forms used on the dam are made up in 5x8-ft. panels consisting of 1x6-in. tongue-and-groove flooring on 2x6-in. studding spaced 2 ft. on centers. Some of these panels have been used continuously for nine months. When warped and cracked due to the alternate wetting and drying the flooring is taken off and the panel re-surfaced. No oil is used on the forms.

The accurate alignment of form panels is given careful attention. When each 5-ft. lift of concrete has taken its initial set the up- and downstream faces of the dam are surveyed and exact locations of the prescribed limits of the structure are marked every 8 ft. In placing the next tier of forms the bottom edge is set to match the top of the forms last placed, whether these are slightly out of alignment or not and the exact locations marked by transit are used to true up the tops of the newly placed panels. Thus slight inaccuracies are corrected without abrupt changes in slope.

The level to which each 5-ft. lift should come is also marked on each new tier of forms by the surveyors, and the carpenters tack a molding along the forms at this level to indicate to the concrete foreman the limit to which he is to pour. This level is usually 1 to 3 in. below the top of the panel.

The form panels are held in place by nine pairs of twisted wires and two rows of pipes, three in each row, which serve as struts to take compression as the wires are twisted taut. The wires are slipped through loops embedded in the concrete and are passed around the outside studding of the forms in the usual way. The struts are made of old pieces of pipe, 1 to 2 in. in diameter. Lengths used in the lower row are about 2½ ft. long and in the upper row about 7 ft. long. At their lower ends the pipes are braced against the rough surface of the concrete and at the top they are wedged under the notch in a short piece of dimension lumber cut for the purpose and arranged as shown in the illustration on p. 467. This is tacked lightly into place so the nails can be loosened easily with a shovel used as a pry, after which the pipe is loose and can be removed easily. The pipes are pulled out the same day the concrete is poured, usually as soon as the fresh concrete, by its thrust against the form, balances the tension of the wires.

Forms are moved upward as work progresses so that little or no problem of form storage exists. At the present stage of the work it takes from six to seven days to complete a pour over the entire top of the dam. This gives ample time for setting and the forms are raised about once a week. The usual plan is to pour each 5-ft. lift in two operations, a depth of about 2½ ft. being placed each time and the area worked being small enough so that the second pour can be made before the first has set.

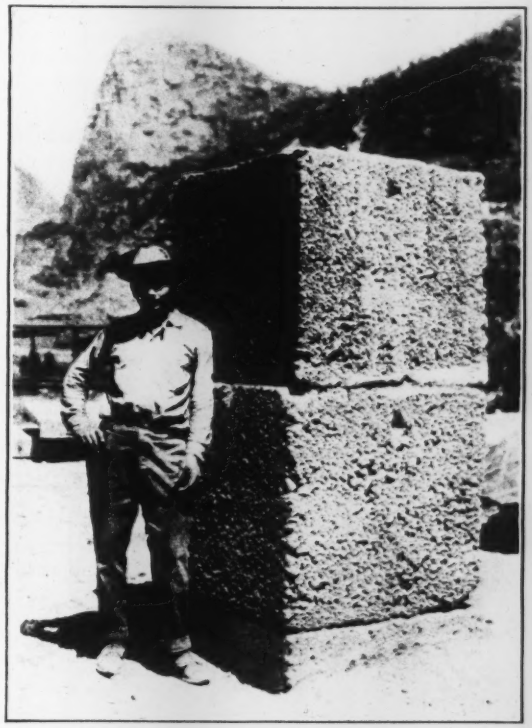
Each concrete gang on the dam consists of six men and a foreman. Five of these men, including the foreman, use shovels a large part of the time and the sixth man is stationed on the chute to clear stoppages and help in manipulating the pulley ropes when shifting the delivery point. The shovel men devote attention chiefly to seeing that the concrete is well spaded alongside of forms, around plums and at the toe of the natural slope of the concrete where honeycombing might otherwise occur. The amount of water in the concrete is so regulated that as delivered on the top of the dam it will take a slope of about 20 deg.

Not less than 10 per cent of the total volume of the dam is to consist of plums, according to the contract, and these are usually placed in large sizes, rock up to 5 tons in weight having been put in. The plums are quarried in a talus slope about three-quarters of a mile above the dam where they are loaded into skips on flat cars which deliver them to derricks on each end of the dam. The plums are delivered to place in the structure by derricks; at the present stage of the work two 10-ton derricks, set on pedestals and equipped with 110-ft. booms serve the major portion of the dam. The

pedestals are about 15 ft. square and as there is need for raising them they are built up 50 to 75 ft. above the surface of the finished work. When a new pedestal is ready the derrick is set up on it in about two days. Plums previously washed and cleaned of soil are placed on top of each 5-ft. layer of concrete at the time of pouring or immediately thereafter. They sink into the concrete by their own weight but project enough to give good bond for successive pours. Only one round of plums is placed in each 5-ft. pour.

Porous concrete blocks were decided upon for drainage wells because it was believed that they would give the maximum drainage perimeter with the least weakening of the structure or sacrifice of weight. The blocks are precast in a yard on the floor of the reservoir and are made 3 ft. 3 in. square and 3 ft. high with a central cored opening 15 in. square. After some experiment it was found that the ideal combination for maximum weight and porosity was a 1:1:8 mix, using rock from ¼- to 1-in. size. Blocks made of this material weigh 3,440 lb. per cu.yd. and show a strength in compression of 994 lb. per sq.in. after twenty-eight days. Satisfactory porosity is shown by the fact that a stream from a 2-in. pipe turned against the side of the block all passes through. They are strong enough to be handled very easily and forms are often removed after three days.

As first cast the blocks were provided with a loop of reinforcing steel embedded in each side to faciltate handling. This was found unnecessary and a depression 1 in. deep is now made in each block about 5 in. below the top. The blocks are lifted by grab hooks which fit into these depressions, the grab hooks being slung from chains and lifted by the derrick. About 1,600 of these blocks have been made of which 750 have already been placed in the dam with practically no breakage. The porous blocks are placed in the bottom of the cutoff trench for its full length, and also in vertical tiers. The latter are 50 ft. apart below stream bed level, and 12 ft. apart from stream-bed to top of the dam. As set in place on the structure about two sections are kept above the level of fresh concrete and the central opening is protected by a wood cover to prevent débris from falling down the well.



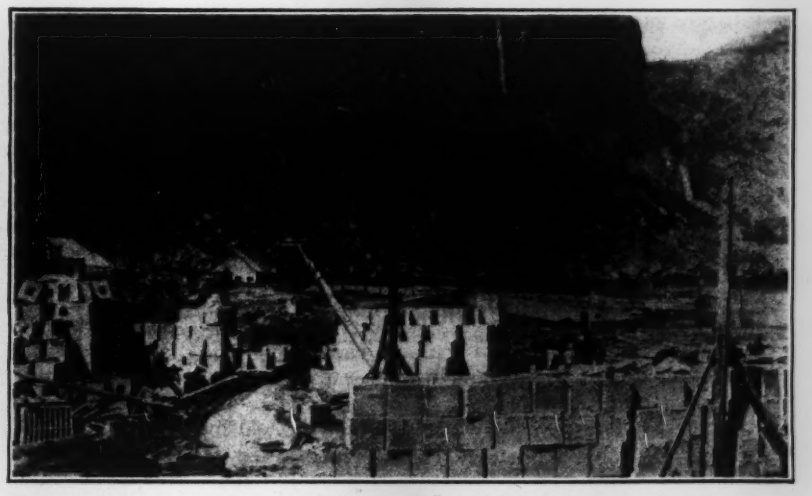
POROUS CONCRETE BLOCKS FOR DRAINAGE WELLS

These blocks are in place on the dam. The top is covered to keep out debris. Note depression near top for grab hooks.

Two 8-hour shifts are worked at the dam. The first shift is on from 6 a.m. to 3 p.m. with a lunch hour from 11 to 12. The second shift works from 4 p.m. to 1 a.m. Except for carpenters who do not work during the second shift, the crews on the dam are the same in both shifts.

Lighting for the second shift is provided by 1,000-watt lamps in dome-type reflectors strung about 150 ft. above the surface of the concrete. It would be desirable to have these nearer the work but it has not been con-

PIPE STRUTS USED TO BRACE CONCRETE FORMS



CASTING YARD WITH MATERIALS PLANT IN BACKGROUND

venient to place them below the derrick guys and other lines, so the overhead lamps, of which six are usually used, are supplemented by three or four additional lamps attached to the tower or convenient points lower down.

In an endeavor to profit by experience on other large dams where the large needle valve castings have been forced out of shape by the concrete in process of setting, special precautions are taken in pouring the concrete around the 5-ft. needle valves which are now being placed. The main valve castings are not embedded in the concrete which is poured with the main body of the dam. Instead a 3-ft. space is maintained by supplementary form work entirely around the valve setting. When ready for finally embedding the valve in concrete, the casting is held rigidly in the exact position desired by short pieces of railroad iron wedged against both inside and outside of the casting. Concrete is then carefully poured around the casting, the bracing outside being embedded by the concrete and left permanently in place.

All seams in the foundation were excavated to solid rock before concreting began, but in the upper portions of the canyon wall, as small seams are encountered, 1½-in. pipes are inserted in them and carried up about 20 ft. When this amount of concrete has been poured above the seam, grout is forced in through the pipe. Due to the considerable height of the structure the side walls were not readily accessible before construction began. Now that they can be easily reached they are again being gone over and all loose material barred down. Water-worn surfaces are either sand-blasted or drilled and shot.

No coal or fuel oil is used on the job. About 22,000 cords of wood, cut in the process of clearing the reservoir and floated down to the dam, is used under the boilers of dinkies, derricks and wherever power other than electricity is required.

Contract for the construction of the dam is held by the Utah Construction Co., for whom H. J. Lawler is superintendent and A. E. Paddock is construction engineer. M. M. O'Shaughnessy is city engineer of San Francisco and is represented by C. R. Rankin, as resident engineer at the dam.

Special Trussed Falsework for Concrete Arch

Design Made in Attempt to Do Away with Support to River Bed Subsequently Provided with Supporting Tower

By Merrill Butler
Bridge Engineer, Arizona Highway Dept., Phoenix, Arizona

Falsework of rather extraordinary detail was designed for the Cienega Creek Bridge recently built by the Arizona Highway Department, but the design after erection appeared to be somewhat unsafe and was therefore supported by a tower through the river bed. Its original detailing and subsequent strengthening seem to be worth description.

The bridge, located about 30 miles southeast of Tucson, Ariz., carries the Benson Bail highway over the Southern Pacific Railroad and the creek which gives it its name. Its central span is a reinforced-concrete arch of 146 ft. span with no particular novelty except that which lies in the fact that the arch rib and the floor are integral for some distance each side of the crown as described in *Engineering News-Record*, August 10, p. 235. At this point the creek is a mere trickle most of the time, but sudden and violent floods are often experienced during the summer and winter months. The bed of the stream is composed of sand and gravel which erodes to a considerable depth during high water and which, therefore, is not particularly well suited for service as falsework foundation. These conditions caused the contractor to select the system of centering shown in the drawing.

In the construction, as indicated in view, Fig. 2, the main trusses were swung out from above and were erected entirely without support from the bed of the creek, which is 70 ft. below the roadway grade. Necessary framing was then built above the trusses and part of the arch ribs beginning at the springline poured as shown in Fig. 2. The falsework for the rib section at the right of the view is supported directly on the natural ground which forms the shore at this point before dipping abruptly to the bed of the stream.

There was no appreciable distortion of the false-

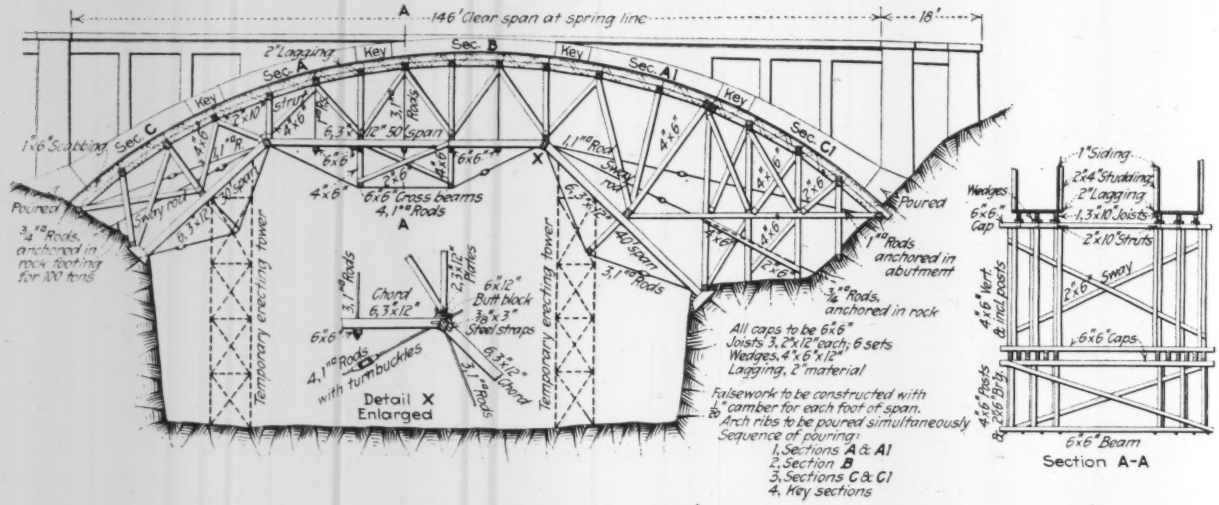


FIG. 1. DESIGN DETAILS OF THE FALSEWORK FOR CIENEGA CREEK ARCH IN ARIZONA
This is for a 146-ft. concrete arch. An additional supporting tower was required before work was started. (See Fig. 3.)

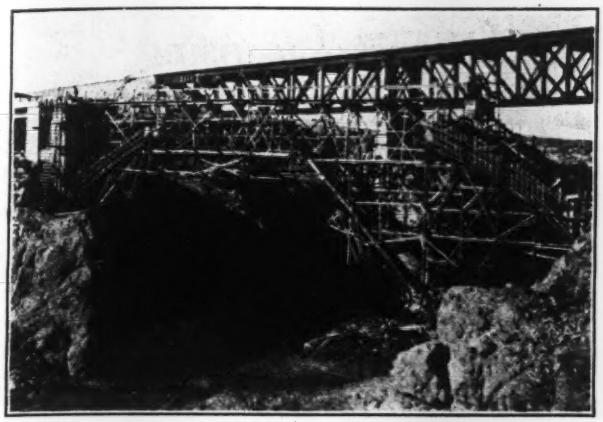


FIG. 2. FALSEWORK AS FIRST ERECTED

work, such as humping up at the crown and pushing endwise during or after these preliminary operations, but the engineers had reluctantly accepted the contractor's design for the falsework as indicated in the drawing and had agreed to its acceptance only on a strict adherence to the drawings and excellent construction details. After the falsework was up it was felt that the work was not as good as it should have been and that there was a considerable variation in the principal dimensions with the result that the falsework neither looked safe nor checked when the stresses were investigated.

The engineer, therefore, insisted that when the arch rings came to be poured across the creek that additional support was required and forced the contractor to put in a tower as shown in Fig. 3. Concrete foundations were prepared to give the necessary bearing for the footings of the tower. The wooden framing was carried up to the trusses and part of the load from them transferred by wedges. The tension rods in the horizontal trusses were then altered to suit the changed location of the support. The crown section, consisting of the monolithic roadway slab and arch ribs, was then poured and followed by the remaining rib section.

No floods in the Cienega Creek occurred during the time the tower was in place and the work was carried to a successful conclusion. The centering was dropped into the river after the tower had been dismantled.

The bridge was designed and built under the direction of Thomas Maddock, state engineer, with the writer as bridge engineer, A. W. Jenkins, resident engineer, and G. B. Little, inspector. English & Pierce of Phoenix, Ariz., were the general contractors.

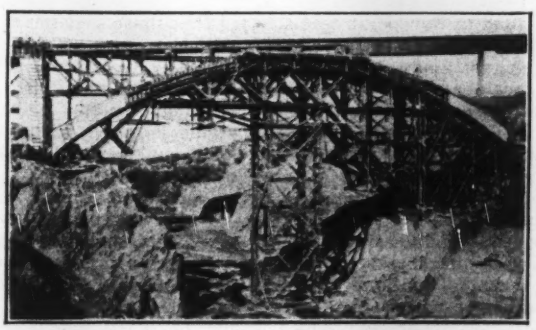


FIG. 3. SUPPORTING TOWER IN PLACE

Water Power Development in Scotland

By R. Johnstone-Taylor
Underdale, Shrewsbury, England

SUPPLEMENTING the note on water-power possibilities in Ireland in *Engineering News-Record*, May 25, 1922, p. 878, attention is called to a government report just issued on the water-powers of Scotland.

Altogether there are nine schemes proposed, estimated to give 183,000 continuous kw. at an average cost of £38 5s., which is about double the present cost of modern steam stations in England. Some leading engineers are now interested in these proposals and have made preliminary surveys of two of the most promising schemes, known as the Lochaber and Grampian proposals. These have recently received Government sanction, and are likely to be proceeded with. Scotland, by reason of its topographical character and its abnormal rainfall is peculiarly suited to water-power developments, although, of course on a comparatively small scale compared to American enterprises.

The first British water-power scheme of any size was put down in Scotland for aluminum refining in 1909 at Kinlochleven, the 3,000 hp. Pelton wheels there exciting considerable interest at the time. The Lochaber scheme is in the same district and may be considered as aiming at utilizing the water power of the West Midlands of Scotland flowing towards the Atlantic. A normal head of 680 ft. will be available, with 880 ft. as a maximum. The drainage area is 303 square miles. It has an average rainfall of 73 in. per year, giving an estimated run-off of 876 million gallons per day. Natural lakes will be utilized as reservoirs, dams 36 ft. high being contemplated to give additional storage. Two of these lakes will be connected by a tunnel 3½ miles long, but the final supply tunnel is proposed to be 15 miles long and 15 ft. in diameter, the lower portion running under pressure. There will be one power station and the power will be utilized for aluminum production. The estimated available power on the Lochaber development is 72,000 hp.

The other proposal is known as the Grampians scheme, the power from which it is proposed to distribute over a wide area for general purposes. In the main it aims at utilizing the water power of the East Midlands gravitating towards the North Sea via the River Tay. The catchment area is 417 square miles divided into two sections and having four power stations. The total available power is estimated at 56,000 kw. The scheme is considered financially favorable. As in the Lochaber proposal natural lakes will be used as reservoirs and dammed 35 to 50 ft. to give additional storage, the total storage capacity being estimated at 100,450 million gallons, while pressure tunnels cut in the solid rock will be a feature of it. The available head at the uppermost of the four power stations will be 450 ft. and 16,000 kw. will be developed, while the lower power station on the same section is intended to give 14,000 kw. on a fall of 150 ft., but with an overload of 100 per cent in wet seasons.

The other section is much smaller, having a gathering area of 32 square miles but natural lakes used as reservoirs and pressure tunnels are also a feature of this section. The two power stations are estimated to develop 4,200 kw. and 7,500 kw. under respective heads of 650 and 870 ft.

Engineers in Many Fields Discuss Licensing

Extracts from Letters Commenting on the Editorial Discussion of the Subject Published in Engineering News-Record of July 6

Since the publication in the issue of July 6, of an editorial discussion on "A Rational Approach to the Licensing Problem," Engineering News-Record has invited comment as to the viewpoint therein presented from a number of representative engineers. Some of these were known to favor the licensing principle, some disapproved and others either were neutral or had never expressed any opinions. The replies that have been received indicate a widespread approval of the principles advanced in our discussion, but few of the writers can find valid reasons for the licensing laws that have been enacted and are now contemplated. The following extracts are from some of these replies. Others appeared in the issue of Aug. 31.—EDITOR.

J. B. Lippincott

Consulting Engineer, Los Angeles, Calif.

I am thoroughly in favor of a license law for engineers. At present we can hardly assume the dignity of a profession because of the very numerous irresponsible and incompetent men who are engaged in this pursuit without any restraint and without adequate qualification.

I cannot agree with your idealistic assumption that in discussing these laws, we must consider only the public welfare and not the selfish interests of the engineer. I think that we, distinctly, as a class, have a right to contend for our rights and for our advancement, specifically for ourselves and more or less as distinct from the question of public welfare. I am sure this has been done by many other professional men where the public interest is not vitally involved. For instance, I find that my dog doctor cannot practise without a license of the State of California. I think that we certainly have the right to receive the same amount of consideration that veterinary surgeons do.

The San Francisco and Los Angeles Chapters of the American Association of Engineers are both working on a law for presentation at the next session of the legislature.

* * *

J. V. Davies

Consulting Engineer, New York.

I think that you are on the right line with respect to the licensing question. This matter is not new, for somewhere or other I have found that in 1830 the question of licensing and regulating the engineering profession was advocated in England by the profession itself "for the purpose of securing greater efficiency in the profession and to promote safety." At that time engineering as a profession was new and there was no sub-division into specialties as now.

The question seems to have lain dormant for many years, but during the last ten or twelve years the legislatures of many states have passed licensing laws more or less simultaneously. Certainly, there has never been a demand either from the public or from the press for the protection (whether of the public or of the profession) that might be expected from such legislation. On the other hand, there seem to have been no enactments requiring that qualified engineers should pass upon and certify the safety of structures and equipment any failure of which may involve the security of the public. This, it seems to me, is completely ignored.

Take, for the purpose of illustration, our own New York law, as I presume most state laws will follow the same general lines. The first section states: "In order to safeguard life, health, and property, any person practising or offering to practise professional engineering * * * shall hereafter be required to submit evidence that he or she is qualified so to practise * * *." No one in whatever humble capacity is permitted to practise professional engineering until he has been duly licensed, but he may be licensed when he is twenty-one years of age, and before he is licensed he must have practised engineering for four years. The certificate issued as the result of this very special investigation as to qualifications states that the party "having given satisfactory evidence that he has the qualifications required by the law is hereby licensed to practise professional engineering." On such a basis as this, what possible protection can the public have that their lives, health, and property are safeguarded? The many branches into which the profession has been split up make the question of qualification to practise engineering on broad lines an absurd and superfluous anachronism. A man who has been trained and is expert in one line of engineering may not be in the slightest degree capable or competent to practise the profession in another line. The law is valueless and of no effect in so far as the protection of the lives, health, and property of the public are concerned.

In the passage of these laws there is no intimation (and the point is carefully avoided) that in them there is any purpose to benefit the profession itself. Reading between the lines, however, it rather appeals to one that they originated in a selfish motive to make a closed corporation of the profession.

Personally, I have no objection to the licensing of civil engineers, but that a civil engineer qualified, competent, and expert in his line in one state should be precluded from practising in another is absurd on the face of it, particularly as a single engineering undertaking often extends beyond the limits of a single state. If out of this chaotic mess of amateurish law making a proper federal requirement could be set up that would not only prescribe the qualifications necessary to practise within the United States but also provide that all public works wherein may be involved the safeguarding of the life, health, and property of the public shall be certified by a responsible and qualified licensed professional engineer, there would be some sense in the application of the licensing principle.

One result of the enactment of licensing laws is the legal establishment of engineering as a profession. It is the official, legal recognition that engineering in its various professional branches necessitates training and skill. As the profession has been built up by the engineering societies here and in Europe, it seems to me that those societies each in its own field are far better qualified to pass upon engineering attainments than would be individuals empowered by each separate state, sometimes politicians with no knowledge of engineering, or by others equally unfitted. It would seem that the qualifications required to become a member of any one of our great engineering societies would constitute a far better criterion for the professional engineer than the present chaos of loosely drawn and perhaps ignorantly conceived laws. When we can get these essential qualifications and proper examination of candidates by a central engineering body with licenses issued by a central authority we shall have arrived at a rational solution of the problem which would be acceptable to the profession itself and which would be worth while as a safeguard for the life, health and property of the public.

I venture to suggest that the Institution of Civil Engi-

neers of Great Britain has presented to us a lesson worthy of consideration. It is seeking to protect the term "civil engineer" by means of a bill to be passed in Parliament setting up a tribunal which shall pass on the qualifications of any one who desires to be termed a "civil engineer." This tribunal would be made up of men named by the president of the Institution. It appears to me that if such a tribunal could be set up in this country consisting of representatives of our engineering societies it would go far toward clearing up the situation.

Whether the state legislatures would be willing to see their licensing powers taken from them by such a nation-wide body is, however, extremely doubtful. I feel, therefore, that this discussion is more or less academic. If the state licensing laws are ill-drawn or unwise, the time to have stopped them was before they were passed, not after. The duty now remaining is to watch carefully and closelv their operation with a view to later amendment or consolidation.

I see in your issue of July 27, 1922, that the state engineering examiners have promulgated a plan by which there may be a recognition of licenses in other than the issuing states. Naturally I am entirely in accord with such a movement and for my part think that if an engineer receives a license in one state it should *ipso facto* give him authority to practice in any state.

* * *

R. D. Coombs

Engineer and Contractor, New York.

Lest he fail to convey his real opinion the writer desires first to record himself as opposed to the general licensing of engineers, either as at present practiced or under any other plan. The present plans cannot accomplish any great public benefit and the writer does not believe that any effective general plan can be evolved. It is believed that such support as the project has thus far received is based on three desires: 1. To "close" the profession and restrict the number of engineers; 2. To provide political place, patronage, and fees; 3. To prevent or decrease accidents, particularly in the building trades.

The present licensing plans will certainly not accomplish the first intention, whether or not that intention is itself desirable and in the public interest. The third desire can more surely be accomplished by enlarging, improving and if necessary licensing the building and related departments of our cities. The head of an engineering or architectural firm might be a competent engineer and the proud possessor of a license but those facts are no guarantee that the final structure will be a safe structure if passed by an incompetent or pliable building department, inspected by absent treatment, and built by a practical and sometimes reckless contractor.

May the writer amend your third principle by omitting the word "ultimate"? The actual designer is the one who should be competent, as his licensed competent and busy superior may never see the details of design. The real protection to the public is the reputation of the concern and the care taken by it to acquire the confidence of its clients.

It would be of interest to know the relative numbers of teachers and consulting engineers as compared with contracting engineers, railroad engineers, etc., who favor the plan of general licensing. The writer is under the impression that the former group furnishes most of the support for the movement and that the latter group does not admit either its practicability or necessity.

Even though it were possible to make any exercise of engineering judgment a misdemeanor if performed by the unlicensed, the enforcement of the law would be impracticable, and how otherwise can the purely engineering group expect to avoid encroachment by those who both design and construct or who *only* construct.

It would seem that the general licensing of engineers is merely another of the many efforts of recent years to make us all better by law and by establishing another federal or municipal agency which, on appointment, becomes miraculously endowed with superior vision and wisdom.

Chas. W. Gustavus

Peninsular Engineering Co., Detroit, Mich.

It was with a great deal of interest and chagrin that I read the statement that the New York Section of the American Institute of Mining Engineers and two engineering societies in Pennsylvania move for repeal of licensing laws. I have also noted from time to time editorials and comment on the question of licensing and would like to express my opinion on the subject.

The fundamental principles for creating an engineers license law are two, namely: the protection of the public and the protection of the engineer. No doubt the ardent advocate of professional ethics would eliminate the protection of the profession, but we must remember that facts as well as theory must be considered. Protection of the profession would itself protect the public. Speaking of protecting the public is a joke. The "poor" public apparently does not give a tinkers dam about the matter until some catastrophe takes place, and within two weeks they have forgotten it entirely. That this is true is being evidenced every day by the employment of contractors with the word "Architect" after their name, or the engagement of an electrical contractor who will furnish a free design.

Suppose we do enact license laws that protect the engineer. Our ethical brethren cry out that such laws constitute class legislation. The architects apparently are not worrying about the class legislation which is in force for their benefit. Nor are the lawyers and doctors. Before going farther, let us straighten out this matter of the public, lawyer and doctor, which some critics insist does not enter into the question. It has been stated that the doctor and lawyer deal with the individual; every man, woman and child being a prospective client. However poor, illiterate or ignorant, the plain citizen has the right to feel that his lawyer or doctor has been vouched for by the state. There is no other way to protect him. The state cannot examine and approve the prescriptions of the doctor, nor the briefs of the attorney, nor has the citizen, in general, the time, the ability, or the resources to investigate the qualifications of this individual into whose hands he is about to entrust his liberty, perhaps his very life.

It has been stated by advocates against licensing that these conditions do not apply in the case of the engineer or architect, that those who seek their services possess capital or command capital, and are in general responsible and of substance. They may be assumed to have intelligence, resources and time to determine the fitness of an engineer or architect. The standards of these investigators will probably be higher, and will certainly be more specialized than any that might be prescribed by the state in a reasonable license law. All this is sheer bosh, bunk and insidious propaganda. The very persons just mentioned are the ones who put up theatres, halls, grandstands and utilities. Who uses them, and whose life is endangered? The "poor" public, of course. So long as the engineers stand by and see these very persons hire plumbers and steamfitters as "expert heating engineers" and wiremen as "electrical engineers" and those other monstrosities that "Civil Engineers Wives" write about, just so long will the public be in danger and the engineers ranking in fourth place instead of the high and esteemed position our ethical brethren are wishing to have them occupy.

Licensing of the engineers, even if it could be termed class legislation and protection, would eliminate this riff-raff, and automatically furnish protection to the public, who are the ones requiring it, not the one engaging the services of the engineer or architect.

But, the critics will say, later work and experience will raise professional ability and trust in the engineers work, and not a license in the hands of the young graduate. It is an easy matter to require a certain amount of actual experience before a license would be granted, thus inspiring those to strive for it who are at least duly qualified, and build up the ranks so that the profession could occupy a dignified position. It is not necessary for the license to specify the business ability and horse sense of the holder of it, as one engineer seems to think. Doctors and lawyers

certificates do not require it. Competition takes care of that phase of the matter.

Further criticism may state that the license committee of the American Society of Civil Engineers, which has been sitting for a year, has not yet arrived at any conclusion justifying a report. This certainly is no reflection on the question under discussion when one considers the time they had deciding matters relative to their constitution, and as Gardner Williams remarked after their heroic efforts, "a careful reading will discover few sections that improve upon the old ones." American Engineering Council also adopted a report on registration. Talk about your milk and water editorials. The committee states it should be beneath the dignity of engineers to fence themselves against qualified competition by the artificial barrier of statute. Licensing provides competition among qualified persons, if anything, which is a reasonable step in a sane direction. Its the unqualified element that disrupts competition.

Other critics would unquestionably ditch registration and protect the public with the building code as it is being formulated at Albany by Commissioner Sayer's labor leaders, actors, health officers and other hot sketches. Sure, let the engineers educate these fellows and start a campaign of public information. That is what engineers are educated for, presumably, and not for engineering work.

Until "some" engineers realize that we must stick together and work together, as that which benefits one benefits all, we will have to listen to the "twaddle" about educating the public and raising professional standards until the cows come home. Registration for protection of the profession protects the public, and cannot be misconstrued as unethical or being class legislation. Here is hoping the mining engineers come up to the surface of the ground and see the light. Pennsylvania has enough poor laws on her books, so for goodness sake leave a few of the good ones on that were fortunate enough to get on.

* * *

Edward Flad,
Consulting Engineer, St. Louis, Mo.

Ought the state to pass upon the qualifications of one who desires to practice engineering and decide whether or not he may represent himself to the general public as an "engineer," issuing licenses to those only who are qualified?

The reasons for requiring licensing may properly be set forth as follows: 1. The protection of the general public against the charlatan or unqualified engineer, so that any one desiring to employ an engineer may know that the state has passed upon his qualifications. 2. The protection of the general public, as far as may be, against damage to life or property from accidents due to faulty design. 3. The protection of the engineer against the competition of the uneducated or inexperienced practitioner, thereby eliminating those who are unqualified and improving the standing of the profession.

Let us consider these reasons in the order above cited.—1. There does not seem to be any demand by the general public for protection against the unqualified engineer.

One who requires the services of an engineer may safely be assumed to be a person of some means, to have the ability required for making the necessary investigation and to have ample opportunity to become fully informed as to the qualifications of the particular individual before engaging him as his engineer. In this respect the engineering profession differs from that of the doctor or the lawyer. It is submitted that licensing would not materially assist the general public in the selection of engineers. The uninformed, the poor, the indigent, need no protection for they do not employ the services of engineers.

2. The protection of the general public against damage from accidents due to faulty design will not be properly accomplished by licensing unless the issuing of licenses is restricted so as to cover specifically each line of work.

An engineer may be qualified by education, training and experience to undertake important work of design and construction and yet not be an expert in all the various branches of engineering involved in the design. His ability to prosecute successfully a particular piece of work depends in large measure upon his ability to select assistants and specialists to supplement the general information which he himself possesses. Let us assume one of our leading engineers should undertake the design and construction of a system of waterworks. This would involve civil engineering, hydraulic engineering, electrical engineering, mechanical engineering and chemical engineering. I doubt if any considerable percentage of our leading waterworks engineers would be fully competent in the details of each of these branches, or able to qualify for licenses which eliminate those not fully qualified in the particular branch of engineering specified in the license. Any form of license which would offer material protection in this respect would undoubtedly eliminate 50 per cent or more of our most prominent engineers and, unless the license when issued did offer such protection, it would be a useless and unreasonable restriction and of no avail, so far as the interest of the general public is concerned.

It is submitted that the public is best protected against damage due to failure of structures by building laws enforced by public officials whose duties require them to check over and pass upon the plans and specifications before permits for their construction are issued, supplemented by such supervisory control as may be necessary during construction.

3. Such benefits as may accrue to the profession from licensing will depend upon the standard of qualifications set up.

If the standard is broad enough to admit all of those who should properly be admitted, licensing will eliminate very few, let us say perhaps 1 per cent of those now practicing. We all know that there are a few in each community who set themselves up as engineers and who are not qualified either by training or experience to practice, but those who should properly be eliminated are so few that they do not offer any serious menace to the standing of the profession. Any narrow restrictions in the licensing requirements, based upon examination as to technical knowledge in each particular branch of engineering for which licenses may be issued, would deprive the public of the services of a large majority of our competent engineers, and so may properly be considered to be against public policy.

Permit me to suggest, therefore, that even if licensing is provided for, the right to practice should not depend upon the possession of a license. Let him practice engineering who will, either with or without a license, and if it is thought that the interest of the profession so requires, license those that desire a certificate of qualification. Such procedure will preserve the right on the part of the public to employ either licensed or unlicensed engineers and the licensed engineer will derive whatever benefit may attach to his certificate of qualifications.

Summing up my views, I am opposed to licensing as a general proposition, holding; that the public interest does not demand licensing of engineers; that any form of license which eliminates only the manifestly unfit will be of so little benefit to the general public as not to warrant the inconvenience and expense to the engineer involved in licensing; that any form of license which would restrict the practice of the profession to those who are technically competent along each of the lines of work undertaken would eliminate 50 per cent or more of our capable engineers and hence would work against the public interest and offer a serious restriction to the practice of the profession; that a form of licensing which will insure qualification in the particular branch of engineering specified, if made optional with the engineer and not a prerequisite to practice, might be of some trifling benefit to both the general public and the profession—but I doubt it!

Architects on Cincinnati Terminal

The architects for the new Dixie Terminal at Cincinnati are Garber & Woodward, and not Barber & Woodward as given in *Engineering News-Record*, Aug. 10, p. 218.

Notes from the Inter-Mountain Country

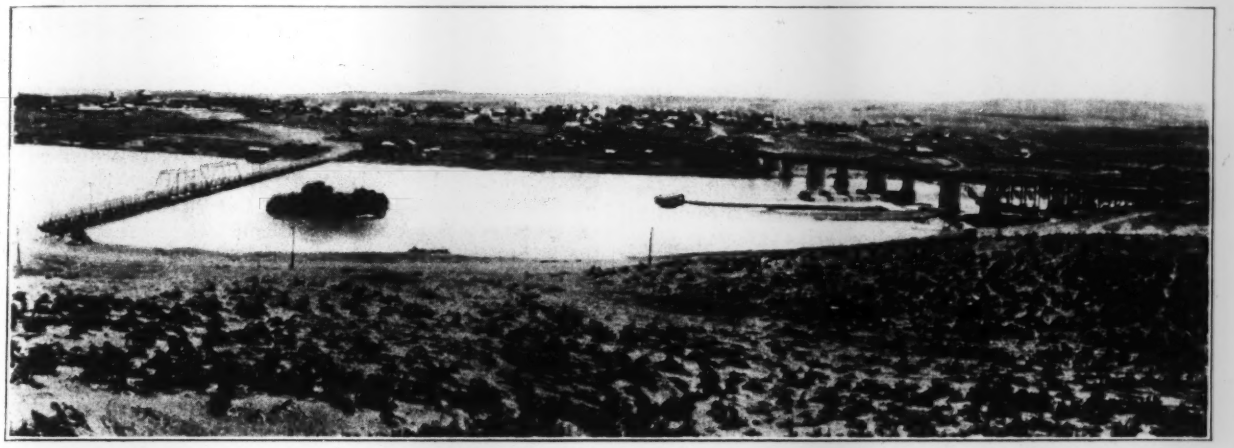
By W. W. DeBerard
Western Editor, *Engineering News-Record*

Southern Idaho, an Engineers' Creation

SOUTHERN IDAHO is traversed by the Snake River in the form of a widely extended letter U. Much of the area adjacent is fairly level lava country of little use, dry but capable of becoming a paradise if irrigated. Irrigation engineers in consequence look upon the oases now existing as objects of their creation. Perhaps nowhere else has the operation of large works remained so largely in the engineers' hands. From water regulation down the river, comparable to train operation, to the detailed management of the projects, engineers retain supervision. Only partially developed as it is, Idaho is and has been for years the scene of more irrigation promotions than almost any other state. The last and largest of them all, the American Falls project, looks to the construction of a two-mile 90-ft. dam which will safeguard the crops on 900,000 acres now in cultivation and a complete water supply for half as much new land. A chance to look over the site of this coming largest of reservoirs with its 3,000,000-acre-ft. storage certainly seemed worth while.

American Falls as a town will have to move when the dam is built through its center. A new town site has been laid out on high ground to which there will be an exodus when the citizens imbibe the faith of the engineers in the certainty of the dam's construction. Meanwhile, the government is buying property and leasing it back to the owners. If construction is delayed another two years few condemnations will be necessary. I visited the new town site and drove down the main street which is marked now only with surveyor's stakes. It will be a pleasant place to live with zoning predetermined and other civic features carefully placed by a professional city planner which the Reclamation Service employed to put it on paper after a detailed study on the ground. Water will have to come up hill, sewage be led down again and the other utilities all fitted in as in the days of cantonment construction, though let us hope without the feverish haste and expense.

Interesting as is contemplation of the wonderful possibilities of making an ideal city the study on the ground of the site of this dam to hold back the largest of artificial bodies of water was more fascinating. Here if anywhere the geologist fixed the center line of the structure. In fact nature fixed it, for the geologists agree that only one line is feasible, and that shortly above the present falls substantially as shown in the photograph on p. 474, taken from the south side standing on the line. Without recourse to geological terms or an attempt to interpret the geologists' report, which more than one engineer already has misinterpreted, the areas both downstream and upstream get into unstable, undesirable or expensive formation difficulties of sandy clay or tufa layers which drillings indicate will be largely avoided at the site selected. The north bank of the river is good rock rising with the country slope and the south side is well compacted non-porous clay into which a core wall will be carried for several hundred feet. The site is a geologist's paradise. The outcrops and nearly perpendicular canyon walls lay bare the faults, successive lava flows, tufa and obsidian with spheroids and other geological phenomena.



AMERICAN FALLS DAM SITE WHERE WILL BE CREATED THE WORLD'S LARGEST RESERVOIR
At the far side of the river rock outcrops at the water edge and dips under the river. The near bank is of clay with occasional strata of fine sand. The irregular U-shaped spillway follows the end of a rock cap.

A trip over a portion of the future 75,000-acre reservoir floor disclosed a wide flood plane covered largely with willows. At the lower end the ranchers eke out a fair living, though hay only could be grown because of the water-logged condition of the ground when any moisture at all is available. However, a large item in the estimated $13,000,000 cost of the project is for overflowed lands.

To see a sample of what the consummation of the work would produce it is only necessary to visit the present projects and this was done by a 150-mile drive down the river from American Falls in company with Barry Dibble, project manager, who knows everyone and everything which could possibly interest an engineer. On the way down the valley two main river structures claim one's attention, the dam for the Minidoka project of the Reclamation Service creating Lake Walcott and Milner Dam built in 1905 by the Kuhns for the two Twin Falls private projects. Three years ago when I was here last, attendants at both dams were bent on saving every last second-foot of water; this year they were wasting water prodigally. I recall

HANSON SUSPENSION BRIDGE 350 FT. ABOVE THE SNAKE RIVER

The first cables were shot across the canyon with a small cannon.

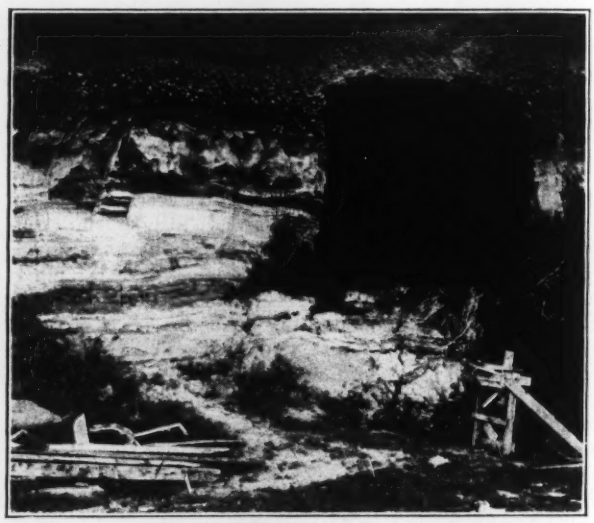
vividly Mr. Dibble's account of reducing to 12 sec.-ft. a 200-sec.-ft. waste through the mile length of stop planks of the Minidoka spillway by $500 worth of 6-oz. canvas tacked over the water face with the flop at the bottom covered with sand. My old notebook further records the fact that canvas was not to be had in Salt Lake but luckily it was found in Denver and shipped on hurriedly by express. At Milner Mr. McConnell put canvas strips between each flash board to make better joints and elaborate plans were made to grout a few small "boils" indicating direct seepage holes through to the rock below the dam. No such worries this year were in evidence, for Jackson Lake, the headwater supply, filled full last winter.

Burley, the largest town on the Minidoka project was not quite so prosperous looking as in 1919. The hotel was run by a receiver, and the dining room was closed. It had a day-after-the-night-before appearance. Houses and stores were for rent and the new school house built on the outskirts of the town a block beyond the last house on the street looked lonesome and probably will remain so for many years. Stories of city real estate orgies come to an end in the court house were rife. Several banks in Idaho quit last year. The potato flour factory which was ready in 1919 to save to the farmer freight costs and put out a product for eastern consumption and to send abroad for starving Europeans never started. The alfalfa meal mill was a success, however. Idaho shared in the expansion after the war and in the depression of 1921 but scarcely anyone spoke of it. Optimism is the Westerner's best asset. Burley has good schools, paved streets and a sanitary, though extremely hard well water supply. Despite these appearances the 1921 crop yielded on the 110,000 acres irrigated $3,400,000 worth of products shipped out in 4,500 cars and purchased wholesale manufactured goods to the extent of $3,430,000. The railway records always indicate that about the same amount of freight comes in as is shipped out. Eighty additional miles of roads were graded at a cost of $1,350,000. The project boasts of 260 miles of graveled roads.

Oakley Dam, about 25 miles south of Burley, is an excellent piece of engineering and example of an earth dam 145 ft. high with a concrete core wall, faced both upstream and downstream with hand placed rock riprap. (See *Engineering News*, p. 516, March 13, 1913.) Up to last year it had never been filled; the water shed is too small. However, last year water ran over the elaborate 600-ft. spillway of 2,000-sec.-ft. capacity for a short time. This year was also unusually wet but no water was wasted though the dam was nearly full. It is the last of the Pittsburgh financier's ventures and somewhere there is a slip in calculating the available runoff. The article noted above states that the duty was fixed at 1½ acre-ft. per acre and the runoff was based on an *average* precipitation from 15 years' record of 9.1 in. The promotion was on a 50,000-acre basis when one-half or less acreage, experience has shown, is all the development is good for. For the sake of making a compact project and to save the losses entailed in long ditches the state has been importuned several times, unsuccessfully, to segregate all of the settlers on 18,000 or 20,000 acres at the upper end of the project compensating those who have put in improvements outside of this area. In 1919 the settlers only had 10½ in. of water the whole season. Trees died. Knowing beforehand of the shortage many farmers put their quota on one-half or less acreage.

But my visit to the Oakley Dam was on a more serious question. At half a dozen points near the downstream toe there were depressions in the riprap. One large "crater" was located about half way up the slope. At two of the depressions quite a stream of leakage could be heard falling some distance. One of the largest sink holes was oval in shape, about 15 ft. long and 12 ft. wide. Last year much more water carrying a heavy turbidity came through when the reservoir was full. The people in the valley below grew quite alarmed though prominent engineers assured them that the leakage meant little. The core wall they claimed was surely intact and the water probably came around the ends of the dam. Nevertheless the operators of this project would do well in the humble opinion of the writer to throw off the riprap and lay bare the earth so as to learn what could then be seen. When 1½ sec.-ft. of water comes through an earth dam even though it is clear a bit more attention would seem advisable.

Twin Falls is an old town and the center of southern Idaho irrigation. Here Perrine, one of the earliest promotors, down in the narrow flat at the foot of the



GEOLOGICAL STRATA AT OLD POWER TUNNEL OUTLET

Soft tufa at bottom, hard lava flow and flint pike obsidian with "spheroids" near top of tunnel.

Snake River canyon walls planted the first irrigated crops in the vicinity. The yields were the lure that built the present development. Perrine's land was protected down in this slot of the earth where semi-tropical conditions prevailed. Fortunately for the promotors the soil and climate on the level stretches above the canyon floor proved equally good when irrigated. Perrine is dead but his good wife still runs the Blue Lakes ranch as it is called and maintains a toll bridge over the river.

Recently Twin Falls acquired a modern rapid filter to treat the ditch water which formerly it used after a short settling period. Bacterial and chemical tests are made daily, said Captain McRoberts, the mayor, who kindly escorted us to the plant and answered most intelligently all of our detailed questions as to difficulties with "mud balls," delayed floculation and short runs. In the winter two serious difficulties arise: The ditch may not carry any water and the temperature is so low that floculation may occur in the filters causing a deposit of aluminum hydrate. Bacteria are reduced from 8,000 to from 20 to 60. Chlorine is used. A turbidity of 80 comes down to zero. Alkalinity ranges from 120 to 15, indicating probably a hydrogen-ion concentration a long ways from the optimum point of coagulaton. It occurred to me that it would be most interesting to sit down with the mayor and his analyst and thresh out for a week if necessary all of the vexatious difficulties which his little 6-m.g.d. plant is as much heir to as are the larger plants at St. Louis or Cleveland. Some day some consulting engineer will make a good living selling his services to these small plants to keep them tuned up. Life in Twin Falls is worth as much as it is in St. Louis.

SINK HOLE DUE TO SEWAGE EITHER THROUGH OR AROUND OAKLEY DAM

Rock riprap on downstream face dropped into hole formed by seepage water carrying away earth below. Hole is 15 ft. across and falling water could be heard. Six such sinks exist, one is half way up slope.

Prospects of the American Falls Project—The farmers in the vicinity of Twin Falls were the last to sign up for the proposed American Falls District which will contain 500,000 acres located in eight counties. Late advices indicate that 1,388 persons owning 142,000 acres (20,000 more than required) did sign, validating the petition. On July 24 the board of county commissioners heard the petitioners in preliminary review. Four weeks later a hearing was to take place and after another interval of four weeks an election on the organization of the district. A bond issue election requires another four weeks' advertising. It is planned to vote $3,000,000 in this district which will need water only in dry seasons. Then obtain $3,000,000 from a district of new land and $3,000,000 from the Reclamation Service. The amount will develop 1,500,000 acre-feet of storage, one-half the ultimate capacity. Acreage at Twin Falls will pay $5 per acre while the new land will pay five or six times as much.

Such is the red tape of big developments. The engineer in Idaho is at the bottom pushing, talking, coaxing and earnestly pleading for a chance to help the other fellow help himself. What he gets out of it is a chance to build something monumental for the betterment of his country and fellow man and incidentally a meager stipend for the brief space of time he is employed. But he is eager to be at the job and get it finished though its very completion means the end of his services.

At the dedication of the Elephant Butte Dam, after congratulating and eulogizing all the dignitaries assembled on the completion of the structure, President Roosevelt turned to the engineers who had in some way places on the speakers' platform. "As for you engineers, you will probably be investigated." Rarely, however, have I heard expression of pessimistic views by the man on the job. He is too busy and truly interested in his job to think of them.

Report Progress in Investigation of Marine Borers

New York Committee Studies Conditions Under Which Borers Thrive—Will Publish Data on Protective Measures

THE local committee organized in New York to co-operate with the National Research Council in its campaign against marine borers (*Engineering News-Record*, Feb. 23, 1922, p. 335) has been studying conditions along the coast between Atlantic City, N. J., and New London, Conn. The committee now consists of about forty members with representation from the engineer and quartermaster corps of the army, the Bureau of Yards and Docks of the navy, and the lighthouse service. Several of the New York City departments are represented and the commissioner of docks is an honorary member. New Jersey is represented by the director of the Board of Commerce and Navigation. The committee includes also representatives of the engineering departments of the railroads and several of the engineers, biologists, and chemists of the city.

On Aug. 22 the committee reported on its work to date and outlined its plans for the future. Eleven hundred copies of a questionnaire have been sent to the owners of waterfront properties within the territory. These were designed to elicit information as to earlier and current attacks of marine borers, as well as data regarding methods of protection that have been used and the measure of success attained. Replies have been received covering about 330 structures. These give valuable information and indicate desirable locations for a more intensive study of the problem.

Inspections and Studies—In order to determine the present locations of the various species of borers, 81 test pieces were fastened to structures in the New York territory. Most of these have been inspected in place by biologists and 60 of them have been replaced by test boards each of which carries 24 blocks. One of these blocks is removed every two weeks and sent in to the headquarters of the investigation. As each block is removed it is replaced by a new one. This plan enables a determination not only of the presence of the

borers but also of the rate at which they work under various conditons. A biological survey also has been undertaken and piles removed from structures have been inspected. As the ravages of the teredo are not readily visible on the surface, it is necessary to cut up the piles in order to make the necessary inspection.

The biological study has shown the presence of limnoria this summer at several locations in Long Island Sound and Jamaica Bay. Live teredo have been found on the New Jersey coast in several places, in Great South Bay, and in New York Harbor proper at Sandy Hook, Perth Amboy, Elizabethport, Fort Hamilton, Clifton and St. George, Staten Island, and Bayonne. Evidence of earlier attacks, some of them dating back many years, was reported from many structures in and around New York harbor.

In order to determine the conditions under which the various borers work, the Board of Estimate and Apportionment of New York City has made at 61 locations, 208 determinations of the temperature, salinity, and dissolved oxygen content of the water, and recently has been making determinations of hydrogen-ion concentration. The committee has recently established six permanent stations at different points in the harbor where these determinations can be made more frequently. A sub-committee of the New York committee in conjunction with the national committee has been collecting and studying records of, and will soon report on, methods of protection for old and new structures.

Future Plans—The plans of the committee for future work provide for a continuance of the biological survey of the harbor to locate additional foci of possible infection and to watch the spread of borers from present locations. The chemical and biological study of the water will be continued and adjusted to the biological findings. It should then be possible to give warning to owners of structures which seem to be in danger from borers. To carry on this work the members of the committee have done much gratuitous work, the railroads have contributed funds, material, and labor. The city of New York and the States of New York and New Jersey through various departments have contributed labor, materials, and boat service. Similar assistance has been furnished also by the army, navy, lighthouse service, and coast guard. The American Museum of Natural History and the New York Aquarium have furnished working space and scientific assistance.

These studies carried on by the New York committee are supplemented by similar work being done at other points on the Atlantic coast, as well as in government and university laboratories. Much assistance is received from city departments as well as from the scientific departments of the federal government and the railroads. The chairman of the New York committee is E. P. Goodrich, and the secretary is C. L. Gamsby, Room 951, 466 Lexington Ave. The director of the national committee is Col. Wm. G. Atwood, Engineering Societies' Building, 29 West 39th St., New York City.

Handling Customers' Water Bills in Toledo

The 45,000 water customers' accounts in Toledo, Ohio, cost in 1921 slightly less than $2 each. This is too much for bookkeeping, billing and collecting, according to the latest annual report of the water department, and steps are being taken to reduce it. Accounting, meter reading and administration cost $9.28 p. m. g. as against $8.52 in 1920.

Constructing Modern Office Buildings in Japan

American Firm Uses American Methods, Personnel, Equipment and Materials in Oriental Construction Work

DURING 1919 the Japanese government sent a group of representative men to the United States and Europe to study building methods with a view to inaugurating in Japan a building-construction program embodying the best methods. The commission, after considerable study, decided that business buildings as erected in the United States were superior to others and in consequence invited the George A. Fuller Co., New York City, to organize a construction company exclusively for oriental work which would have as its first job the erection of modern office buildings in Japan. The construction company known as the George A. Fuller Co. of the Orient, Ltd., was organized therefore upon the invitation of such men as the late Baron Rempei Kondo, president of the Nippon Yusen Kaisha, and Baron Shibusawa, a member of the recent Peace Commission.

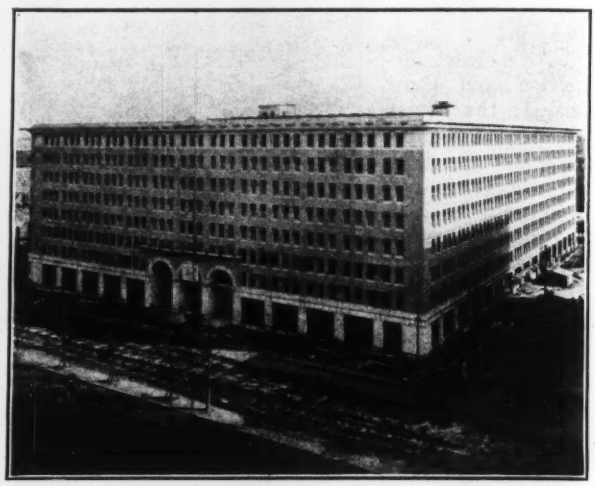


FIG. 1—MARUNOUCHI BUILDING IN TOKYO

This building was erected for renting and investment purposes and is the largest of the four buildings herein described, having a rentable floor area of 632,000 sq. ft.

Buildings in Tokyo—The construction company sent an organization to Tokyo in January, 1920, to start a campaign of modernizing building industry in the far East. It was the desire of the Japanese that this organization not merely act as builders, but as teachers to train Japanese architects, engineers and mechanics in modern American construction methods. The company is now constructing four buildings in Japan, three of which are being built in Tokyo and one in Kobe. There is also under consideration an extensive construction program for Dairen, Manchuria (North China). The largest of the Japanese operations is the Marunouchi Building owned by the Mitsubishi Goshi Kaisha, which is an office building to be used entirely for renting and investment purposes. The cost of the structure when complete will be approximately $5,000,000. The ground area is 335 x 275 ft., and the building is 100 ft. high, or the equivalent of eight stories. Rentable floor area amounts to 632,000 sq.ft. The street façade has a

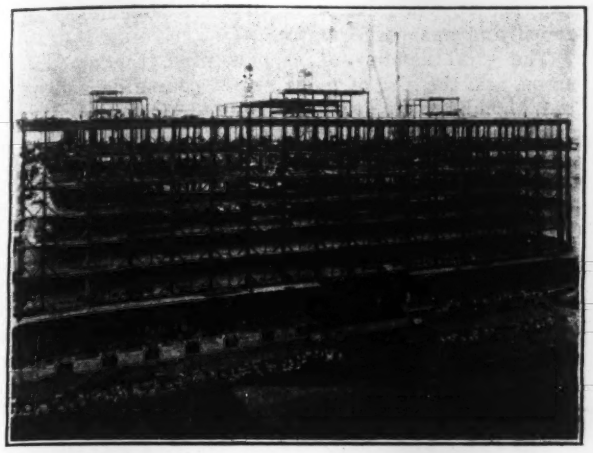


FIG. 2—JAPAN MAIL STEAMSHIP BUILDING

Japanese granite base course with cast stone to the second story sill line, above which the building is faced with local Japanese facing tile up to and including the seventh story. The eighth story is faced with cast stone and stucco. This building is of skeleton steel frame construction with reinforced-concrete floor arches, and is equipped with ten passenger elevators and one freight elevator. It will be completed by November of this year.

The second building is the Nippon Yusen Kaisha building, which is an office structure built principally to house the head offices of the Japan Mail Steamship Co. This building is approximately 290 x 160 ft. in ground plan and is seven stories in height, or approximately 100 ft. The building has a Japanese granite base course on the street façades and ornamental terra cotta for the balance of the street elevations. It is also of skeleton steel frame construction with reinforced-concrete floor arches, containing seven passenger and one service elevator, and will cost approximately $3,000,000. It covers 312,000 sq.ft. of floor space and also will be ready for occupancy by November of this year.

The Japan Oil Co. Building, which is being erected for the Japan Oil Co., Ltd., is the third building constructed in Tokyo and is about 165 x 160 ft. in area and seven stories in height. No buildings may be erected higher than 100 ft., according to the Tokyo building laws. This building also has a Japanese granite base, the first two stories are of Japanese cut stone, while the upper portions on the street fronts are faced with architectural terra cotta. This building is also of steel frame construction with reinforced-concrete floor arches. The cost will be about $2,000,000. It is now ready for occupancy.

In Kobe is being erected the Crescent Building for Messrs. Brunner, Mond & Co., (Japan) Ltd. The George A. Fuller Co., of the Orient, Ltd., acted in the combined capacity of engineers, architects and contractors for this building. It covers a plot 90 ft. square, and is six stories in height. Unlike the Tokyo buildings, it is constructed of reinforced concrete with long-span floor tile arches. The street façade is faced with Japanese granite base course, above which architectural terra cotta facing is used. The floor space in this building amounts to 43,000 sq.ft. When complete the building will cost approximately $325,000. This will be an office building used largely for housing the forces of the Brunner, Mond Co.

American Machinery and Materials Used—All buildings under construction are built in accordance with modern American construction practice, and American machinery is used practically throughout. Electrically-driven equipment, such as hoists, concrete mixers, engines, cranes and other power tools and plant had to be imported into Japan from the United States. Materials used in the construction in these buildings were also imported from the United States. The total value of imported materials is about $3,500,000, and that of construction machinery $250,000. In the list of materials shipped from the United States, are the following: fabricated structural steel, Oregon pine piles, architectural terra cotta, all materials for mechanical trades, such as heating, plumbing fixtures and pipe, radiators, boilers, fittings, etc., and electrical material; copper and iron doors, jambs and trim, polished plate and wire

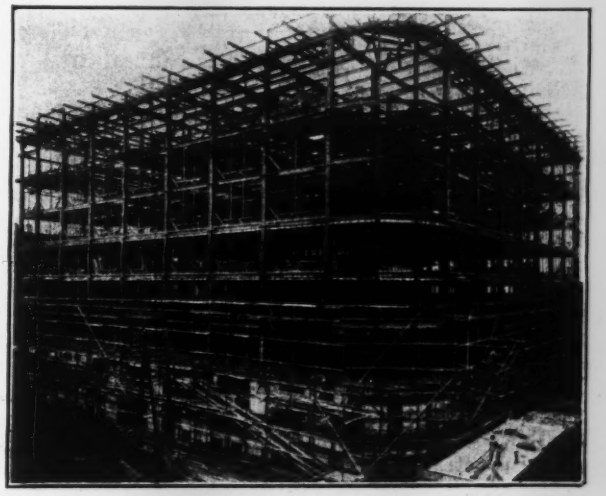


FIG. 3—JAPAN OIL BUILDING
Note heavy wind or earthquake bracing and round timber staging.

glass, mail chutes, sash chain and fixtures, wire-cloth reinforcing material, kitchen equipment, vault doors, finished hardware, linoleum, etc.

About 13,000 Oregon pine piles were sent from the Pacific Coast, together with 11,000 tons of structural steel, fabricated complete, 1,300 tons of ornamental terra cotta, 82 miles of plumbing, heating and electric piping; 75 miles of electric cable and wire and 25 elevators. Aside from these large items, a great quantity of imported miscellaneous specialties were required. In order to handle this large quantity of imported materials the construction company established a storage yard with docking facilities at Shibaura, Tokyo Bay, as a concentration point and all materials were distributed from that point to the various Tokyo buildings.

Local materials which were used were sand, cement, stone, lime, plaster and other materials which conformed as nearly as possible, if not entirely, with specifications for like products manufactured in the United States.

Japanese Eager to Learn—One of the features of the work was the readiness and in fact, eagerness with which Japanese construction workmen followed instructions from American superintendents. In the main, the

skeleton staff of mechanics in the several trades was sent from the United States and the engineering staff with various superintedents and foremen also were Americans. Japanese labor was utilized almost exclusively, instruction being given through interpreters.

Though the construction of these buildings lacked spectacular features, two main difficulties were encountered which were peculiar to the Japanese buildings. By reason of the very poor soil encountered at the sites of the three Tokyo buildings, it was necessary to use long pine piles under foundation footings. Then by reason of the limited facilities for disposing of excavated materials, the use of steam shovels was not practicable. Also the roads in the neighborhood of Tokyo are not substantial enough to withstand loads imposed by motor trucks in service for hauling structural steel and other material. These objectionable points were overcome by applying the native methods of transportation supplemented by American methods.

The New York manager of the George A. Fuller Co., of the Orient, Ltd., is William Oehrle.

"Inverted Penetration" Macadam Roads in Texas

By A. D. Stivers

Engineer, The Texas Co., Houston, Tex.

A TYPE of wearing surface for highways, which has been giving good service in Texas for more than four years, is known locally as inverted penetration. It is successfully laid, with a thickness of 1½ in. on macadam, gravel, and shell bases. As in the case with any type of highway surfacing, inverted penetration is no better than the base on which it is laid.

While it is difficult to set a minimum thickness of base, it is the opinion that 6 in. of macadam, 8 in. of gravel, or 10 in. of shell, compacted thickness, is the least that will justify the expense of a high-class inverted penetration surface. Where the traffic is heavy or the subsoil is poor, this thickness should be increased. An old road which has been in use for several years makes an excellent base if it is not worn into holes or worn so thin that it does not have adequate strength.

Inverted penetration differs from ordinary penetration macadam in the respect that the penetration of the asphalt into the voids of the stone is largely from below toward the surface. The surface is applied in two or three courses on a base thoroughly broomed to remove all dust immediately before the application of the asphalt. Some contractors lightly sprinkle the base prior to the application of asphalt in order to remove the dust film from the surface.

The first application is made directly on the base, with a pressure distributor, at the rate of from 0.3 to 0.6 gal. per square yard depending on the thickness of surface to be constructed. This is immediately followed by crushed stone spread by hand from piles already placed alongside the road. The stone in this first coat should be, in its maximum dimension, at least as great as the thickness of mat desired and in quantity sufficient more than to take up the amount of asphalt applied to the subgrade. This stone is then rolled and receives another application of from 0.25 to 0.4 gal. of asphalt per square yard. The second application of asphalt is usually covered with stone from ¾ to ⅜ in. in size and the surface is again rolled. It is then given another light application of asphalt of from 0.25 to 0.3 gal. per square yard, covered with screenings, again rolled and opened to traffic.

The total amount of asphalt used, the amount of stone, and the size of stone are of course dependent on the thickness of asphaltic mat desired. A typical example would be as follows:

LAYING ROCK BASE FOR PENETRATION MACADAM ROAD

First application: 0.6 gal. of asphalt covered with 1½ in. to ¾ in. stone, 1 cu.yd. to 27 sq.yd.

Second application: 0.4 gal. of asphalt covered with ¾ in. to ⅜ in. stone, 1 cu.yd. to 60 sq.yd.

Third application: 0.25 gal. of asphalt covered with screenings, dust removed, 1 cu.yd. to 100 sq.yd. These amounts of material will build up a mat approximately 1½ in. thick.

The asphalt used on most jobs so far constructed in Texas has been Texaco No. 250. This is a very soft asphalt having a penetration of from 250 to 300 at 77 deg. F. Of late the tendency among engineers has been toward the use of a harder asphalt, between 110 and 140 penetration.

Various kinds of stone have been used. Good results have been obtained with trap rock, and hard limestone for the coarser material and with hard limestone, Joplin chat and pea gravel for the screenings. It is of course important that whatever stone is used shall be perfectly clean and dry and be spread evenly over the surface by trained men.

The cost of this type of construction is much less than that of ordinary penetration macadam and where the work is carefully done the wearing surface is smooth, pleasant to the eye, of low traffic resistance, and stands up well under heavy traffic. Roads of this type have been constructed or contracted for in Tarrant, Greeg, Parker, Denton, Hill, Kaufman, Tom Green, Hunt, Harris, Atascosa and Debb Counties. Most of these are Federal Aid Projects.

Data on Coal-Bin Design

By a misprint in R. Fleming's article "Some Data on the Design of Steel Coal Bins," pp. 346-350, Aug. 31, the Panama Canal coal bunkers at Cristobal and Balboa were described as 500-ton bunkers, whereas the correct figure is 1,500. In Table III of the same article, p. 349, first column, the fifth heading "Water 25 lb. per cu.ft." should have the figure changed to 62.5. Finally, in the next column of the same page, line 5, the maximum load-intensity for triangular loading on a beam should be read as $2W/l$ instead of W/l; the calculation following applies to the correct figure.

Water-Works Problems and Practice

Abstracts of Papers and Discussions Before New England Water Works Association

Making and Testing Valves for Boston Water Division

By Thomas E. Lally
Assistant Engineer, Water Division, Boston, Mass.

During the past fifteen years the Boston water-works has had many hundred gates built outside of its own shop. The city furnishes everything necessary to assemble the gates, in the rough: Iron castings, composition castings, flange bolts, gasket and packing. The contractor does all the machine work, assembles the machined parts, and tests and delivers the finished gates to our yard. The machine work is inspected before assembling and must conform to our standards for finish and size and type of threads, and all similar parts must be interchangeable. Test bars, 26 x 2 x 1 in., on supports 24 in. apart, must show a deflection of at least 0.3 in. under a load of 19,000 lb. before breaking. The castings are inspected at the foundry for size, thickness of walls, dirty or spongy iron, cold shuts or blow holes.

In testing the finished gates, the gate is closed on one bell by a cap or head. The closed bell and gate is then filled with water. The valve is slightly raised to allow the water to fill the bonnet, the air escaping through the gland which was loosened for that purpose. After the gate is full of water the valve is subjected to a pressure of 150 lb. per square inch. The other side is then tested. This process duplicates the conditions in the line as nearly as may be and has been found very satisfactory. It shows up defects and exposes spongy places in the castings. It is preferred to the method of tapping in a piece of pipe in the bonnet and subjecting the bonnet and the parts surrounding the valve to the pressure but getting no pressure on the bells. This latter method is cheaper for the manufacturer and consequently is in almost universal use in commercial gates. It is my opinion that the commercial method is of advantage in the type of gate having loose disks because it tends to force both disks into seat at the same time at one operation. With the solid wedge type of gate which we use I do not advocate it. Our method will detect the slightest difference in taper between the seat in the body and the valve rings. We require the beaten-in seats and valve rings to be pinned. The nut through which the stems in all gates over 10 in. operates to lift the valve, is also pinned in to prevent the stem from turning it out.

* * *

High-Pressure Fire Systems from the Underwriters' Viewpoint

By G. W. Booth
Chief Engineer, Committee on Fire Prevention and Engineering Standards, the National Board of Fire Underwriters, New York City

Conflagrations spread either by the generation of a heat wave of such intensity that everything combustible in its path is involved, or by means of flying brands carried by the wind far in advance of the origin of the fire that set fire to combustible roofs or porches. The first type of conflagration is that of which we must think in considering the installation of high-pressure fire systems, since most of them occur in high-value congested districts and it is only in such districts that the expense of installing and maintaining a separate fire main system can be warranted.

Nine out of the 18 cities which have installed special pumping stations for separate fire main systems have a population in excess of 400,000; 4 of the other 9 are in excess of 200,000 and most of the others either present special fire protection problems or were able to take advantage of favorable conditions to minimize the cost of installation or of maintenance or both.

Use of New York High-Pressure System — Since July, 1908, when the high-pressure fire system was put in service in Manhattan, the most extensive use made of it was in January, 1909, when it was brought into service for five simultaneous fires, three of them of more than usual severity, and one particularly so. At the extreme, seven pumps were being operated, delivering 33,500 gal. per minute against an average preassure of 225 lb. at the pumps and 205 lb. at the hydrants. Forty engine companies were called, including more than 600 men, and all the water thrown on the fire was from the high-pressure system.

The system was also used on the occasion of the Equitable Building fire, and at a difficult fire in a general storage warehouse fire on Jane St. in July, 1922. Because of a disastrous explosion in the early stages of the Jane St. fire, it was not considered safe for firemen to remain in the building, and the fire was therefore drowned by streams from the outside; at one time 60 large streams, using a total of over 30,000 gal. per minute, were in service, at a pressure of about 200 lb. at the hydrant, and a total of 87,000,000 gal. of water is reported to have been used. Each of these streams would require, if fire engines were used, the services of one fire company, whereas each company can lay and handle at least two or three lines from a high-pressure hydrant to turret nozzles or water towers. It follows, therefore, that fewer companies will be required for fires calling for large quantities of water, and a much smaller part of the city will be stripped of its normal protection.

* * *

Boston High-Pressure Fire System

By F. A. McInnes
Division Engineer, Public Works Department, Water Division, Boston, Mass.

The Boston high-pressure fire system, as now proposed, will protect about one square mile of territory covering practically the entire congested value district of the city. It will consist of eight pumping units in three separate stations with 19 miles of mains. It is designed to operate, if the necessity should arise, at a pressure of 300 lb. per square inch. Two stations with four pumping units, 11.75 miles of mains and 313 hydrants have been in service for the past eight months, furnishing approximately two-thirds the measure of protection which the completed system will afford.

Pumping Station No. 1 includes two 3-stage double-suction centrifugal Worthington pumps, each directly connected to a Westinghouse 750-hp. steam turbine operating at 1,165 r.p.m. with a steam pressure of 175 lb., atmospheric exhaust. Two 16-in. suction mains connect with the low-service distribution system (pressure 55 lb.); one of them also connects with the high-service distribution system (pressure 85 to 90 lb.). A 16-in. suction main connects with the intake conduit supplying salt water from the Harbor to the Boston Elevated power station for condensing purposes. A centrifugal vacuum pump, with 75-gal. priming tank, driven by a 10-hp. 220-volt d.c. motor is provided to prime the fire pumps when salt water is used. Two 16-in. discharge mains, each equipped with a venturi meter, extend from the station to the high-pressure fire distribution system. A vertical centrifugal single-stage sump pump, driven by a 220-volt d.c. motor, takes care of any leakage, etc., in the station.

The [station] water piping is of cast-iron, with flanged joints, each piece of pipe in the force main being separately tested at a pressure of 600 lb. per square inch before being assembled. A 4-in. by-pass, equipped with the necessary check valves and meter, is provided between the suction and discharge sides of the piping to insure the absence of air in the system and to provide means of measuring the water leakage.

The principle control valves on the piping system are electrically operated by Deane control. Ross regulating valves are installed between the suction and discharge of each pump by means of which the pressures at the pumps are controlled from the operating board, upon which the necessary gages and indicators are installed and from which the valves in the piping system, the vacuum pump and the sump pump are operated.

The turbines are started by hand throttle. Steam is supplied through an 8-in. loop pipe connecting to each end of the steam header in the boiler room of the Boston Elevated station, where 20 Babcock and Wilcox boilers with a total of 10,344 hp. are located; eight to ten of these boilers are always in service.

At a test recently made by the National Board of Fire Underwriters, Pump No. 1 discharged 3,100 gal. per min. at 301 lb. pressure and 4,676 gal. per min. at 201 lb. pressure. Pump No. 2 discharged 3,114 gal. per min. at 300 lb. pressure; 5,164 gal. per min. at 209 lb. pressure, and 7,400 gal. per min. at 100 lb. pressure. The two pumps operating together discharged 6,580 gal. per min. at 292 lb. pressure and 10,266 gal. per min. at 201 lb. pressure.

Pumping Station No. 2 has two 4-stage single-suction centrifugal Worthington pumps, each directly connected through semi-flexible couplings with a 750-hp. 235-volt d.c. shunt-wound commutating pole Westinghouse motor with a speed range of 860 to 1,050 revolutions per minute. Power for operating the pumps is furnished through cables extending to the pump room from the main switchboard in the generating room of the Edison Third station.

Distribution System—The system was designed to deliver 12,000 gal. per min. about any block, with a hydrant pressure of 250 lb. per square inch, and a pump pressure of 300 lb. per square inch. As a matter of fact, the efficiency of the system exceeds this requirement, as during construction the sizes of mains were increased in several instances to provide for different proposed locations of pumping stations. One hydrant is allowed for each 40,000 sq.ft. of area.

The system now consists of 20,140 lin.ft. of 20-in. pipe, 1.51 in. thick; 28,808 ft. of 16-in. pipe, 1.27 in. thick; 13,081 ft. of 12-in. pipe, 1.04 in. thick; and 313 hydrants supplied by 8-in. pipe 0.8 in. thick. The straight pipe and special castings are of cast-iron, except that for branches where the opening from the run is 12 in. or over semi-steel is used. Two lead grooves are cast in the bell end and in the spigot end of each pipe; and similar grooves are turned, on the job, in the ends of any cut pipe. The joint material used where unbalanced pressures exist, or might develop, is an alloy of 95 per cent lead and 5 per cent tin. Extensive preliminary tests showed that the admixture of tin increased the strength of the joint sufficiently to safely permit tie rods to be dispensed with, a conclusion that has been verified in practice. All joints are made as follows: A small pot is kept warm, floating in a larger kettle of hot lead. When the joint is to be made, sufficient lead is measured into the pouring pot and the necessary amount of block tin is added at the last minute. The calking is done with dog tools, using a two-handed 4-lb. hammer, a starting chisel and three sets of calking chisels. The joint is finished or polished off with hand tools.

The post hydrant was designed and patented by Joseph A. Rourke, now commissioner of public works of Boston. It is of rugged design, with 8½-in. barrel, 6½-in. main valve opening against the pressure and four 2½-in. independently-controlled outlets. A notable feature of the design is an auxiliary valve formed by a three-way cock operated by a covered stem extending along the side of the barrel and terminating in an operating nut located at the head of the hydrant. One position of the three-way cock closes the waste and equalizes the pressure above and below the main valve in the hydrant barrel. The other position opens the waste and closes the connection with the hydrant barrel. The hydrant was designed for a normal delivery of 2,000 gal. per minute, the loss at this flow being less than eight pounds.

* * *

Leadite Joints and Machines for Pipe Laying at New Bedford

By Stephen H. Taylor
Superintendent of Water-Works, New Bedford, Mass.

In 1920 the New Bedford Water Department had about 6,600 ft. of 36-in. cast-iron main to lay in addition to the ordinary extensions. As labor was scarce, it was decided to purchase a 14B Bucyrus steam shovel with an extended dipper arm for trenching, and in 1921 when the 48-in. cast-iron main was started a 14B Bucyrus clamshell and derrick machine with a 30-ft. boom was bought. These machines have proved great money savers on the large pipe work which has been done in the past three years. The latter machine is used for pipe laying, and in places where the ground is too soft to support the steam shovel over the trench, excavating is done with the clamshell outfit on the same machine. Under ordinary conditions the excavation is done by the steam shovel traveling on platforms over the trench with the derrick following close behind, laying the pipe. The shovel deposits the excavated material into trucks which haul it directly to the backfill close behind, or to the spoil bank.

With reasonably good conditions from 120 to 180 ft. of trenching, pipe laying and backfilling per day is accomplished with a crew of from 15 to 20 men, two or three trucks, and the steam shovel and derrick. The advantage of a small crew is particularly great in our present work, which is ten to twelve miles from the city, requiring that the men be boarded near or transported to and from the job.

Tests of Leadite and Lead Hydrotite Joints—Some ten years ago a few joints in our smaller-sized cast-iron pipe were made with leadite and lead hydrotite. No trouble has ever been experienced from either. In the spring of 1920 I decided to make more extensive experiments with these substitutes for poured lead joints.

At that time leadite was offered at 12c. per pound and lead hydrotite at 10c., while lead was selling for about 7½c. per pound. One pound of either substitute would fill as much joint space as 4 lb. of lead, so that it would take 30c. worth of lead to do the same work as 10c. worth of hydrotite or 12c. worth of leadite. There is also a further saving in the reduced labor cost, because no calking is necessary, and the size of bell holes is greatly reduced. The only chance of skepticism, then, was as to their efficiency. As the contemplated work involved a considerable amount of jointing material, the 2c. per pound difference in cost of leadite and hydrotite was worth saving if the two materials were equally efficient.

Tests with 6-In. Pipe—Six lengths of 6-in. pipe were put together on skids about 2 ft. high, with a plug and sleeve on one end made up with lead and a patented plug in the other. Three joints were made of leadite and three of hydrotite. Dry white jute was used in its different forms. One joint with each material was made with loose yarn, one with the same yarn twisted lightly, and a third with the same yarn braided.

The pipes were first filled at city pressure (84 lb.) and the joints were all reasonably tight, the greatest leak occurring at the joint made of leadite with loose yarn. There was also some leak at the joint made of hydrotite with twisted yarn. The pressure was then raised, first to 150 lb. and then to 200 lb., all joints remaining reasonably tight and becoming entirely so with the exception of the two above mentioned. The high pressure was then released and normal yard pressure (84 lb.) maintained during the remainder of the test.

The ends of the pipe were raised by means of a derrick at each end, the supports, which were under the pipe, being removed as the pipes were lifted from them until, for a short time the line was practically suspended by the ends, forming a curve with about 144 ft. radius and the ends of 5 ft. 9 in. higher than the center. Finally joint No. 5, hydrotite, broke, allowing the center of the line to drop to the ground. It should be said, in fairness, that the joint which failed was not made with a continuous pouring, because some of the material was lost through a defective dam and a second pouring was necessary. Only a few seconds elapsed between the first and second pouring, however, as the kettle was close to the joint and it was only necessary to dip out more material. The whole line was then lowered to the ground and remained tight except the two joints before mentioned (Nos. 2 and 5.) These were made tight by caulking with a little lead wool, and for several months the line remained in the yard absolutely in tight condition, in spite of the abuse to which it had been subjected.

Experiments with 36-In. Pipe—As the principal work of the year was to be 36-in. pipe, it was thought advisable to experiment with this larger size to see if it could be successfully poured. Two lengths of 36-in. pipe were joined, with a plug in one bell and a sleeve and plug on the spigot end. Accidentally a class B pipe, N.E.W.W. specifications, was placed into a class F bell. This made an unduly thick joint (about ⅜ in.). The class B bell was too small to receive the beaded end of the plug, so the plug was reversed. This made an abnormally thin joint with no bead, as the space was so small that it would have been impossible to caulk a lead joint. These joints were made with leadite. On the other end the sleeve and plug were normal ½-in. joints and were poured with lead hydrotite.

When the yard pressure was applied, in spite of the bracing at the ends, the joints between the two pipes slipped about ¾ in. This was the abnormally thick joint. The 84 lb. yard pressure on the 36-in. plugs developed a total stress on each of them of about 42½ tons. The braces were then removed and the pressure applied with the intention of pulling the work apart. When this was done the two abnormal joints made with leadite held fast, and the one where the sleeve joined the pipe, which was a normal ½-in. joint made with hydrotite, pulled apart.

As a result of these tests, it was decided to adopt leadite for our work, and it has been used in practically all the joints made since that time with excellent results.

The story of this test would not be complete without further reference to the advantage of the braided jute packing, which we have also adopted for general use. We find that although it costs a little over twice as much per pound as the plain dry jute, the saving effected in labor and material more than offsets the extra cost, and that a better joint is obtained because there are no loose ends of the fiber to mix with the jointing material and reduce its efficiency.

Comparative Cost of 48-In. Lead and Leadite Joints—Recently a very favorable opportunity was presented for comparing the cost of 48-in. joints made of lead and leadite, as two joints were made of lead on the check valves of our 48-in. line, because of the extreme weight of the casting and uncertainty of the ground in which it was placed. Figuring the cost of jute packing, labor and lead, a 48-in. joint cost $18.06; whereas the same items on a leadite joint cost an average of $4.42. It took three men 1 hr. and 40 min. to pour and caulk a lead joint, whereas the same three men would average to pour from six to eight joints per hour with leadite.

Discussion: An extended discussion brought out much opinion favorable to leadite, and less extensive but favorable accounts of experience with lead, hydrotite and metallium as jointing materials. On the subject of relative costs of cast-iron and steel pipe, Mr. Taylor said that by doing its own work the city was getting the 48-in. cast-iron pipe in the ground for about what a steel pipe line would cost.

Shorter Abstracts with Discussion

Water Quality, Service Pipes, and Plumbing—With particular consideration to the water supplied in the Boston Metropolitan District, D. A. Heffernan, superintendent of the Water Department of Milton, Mass., read a paper on "The Quality of Water and Its Relation to the Life and Proper Operation of Service Pipes and Plumbing Appliances." He charged (1) the Massachusetts State Board of Health with "apparent indifference" as to the quality of water supplied in the Metropolitan District, and (2) "the great majority" of water-works superintendents with knowing "too little of the quality of their water" as regards its "action on pipe."

"In 1912," said Mr. Heffernan, "Milton began to use exclusively for its services genuine black wrought-iron pipe, carefully lined with Rosendale cement in our own shop." Lead-lined couplings and lead goosenecks were also adopted, but fittings other than the lead-lined couplings were of brass. About 1920, or eight years later, it was found that "violent galvanic action" was "eating away the pipe at the threads inside the brass fittings and almost completely filling up the latter." Present practice at Milton "is to line all fittings and stops with lead, so that no water comes in contact with any two metals other than lead and brass or lead and iron. The old brass fittings are being gradually replaced with lead-lined malleable iron."

The danger of corrosion of the relief and vacuum valves on direct-pressure kitchen boilers, with resultant sticking, due to corrosion by the kind of water commonly supplied, was urged by Mr. Heffernan, as also the evils of brass connections to galvanized steel boilers and brass couplings in ½-in. galvanized pipe connections to boilers, with resultant filling of the pipe with rust.

In conclusion, Mr. Heffernan urged (1) that something should be done to lessen the action of water on piping—either treatment or control of action caused by grounding electric wires on pipe, or both; and (2) the creation of State Board for the Regulation of Plumbing "which would forbid the use of some wasteful (and dangerous) devices and regulate the use of others," thus cutting down water consumption and postponing (notably in the Boston Metropolitan District) the necessity for new water supplies.

Discussion: The discussion on Mr. Heffernan's paper centered in a general and hearty condemnation of the use of relief and vacuum valves on domestic boilers and of check valves between the boilers and meters. George W. Fuller, speaking of the corrosion problem, said it is big and complex. Usually, water analyses do not take corrosive qualities into account. Lime, after filtration, may be used to prevent corrosion, as planned for Buffalo and Memphis, Tenn.

Co-operation—The benefits of co-operation between the water authorities and consumers on the one hand, and the authorities and employees on the other, were presented by Francis T. Kemble, secretary New Rochelle (N. Y.) Water Co. The labor side of this paper aroused considerable discussion. The pension system, all-the-year work, more flexibility in wage rates, more human touch, were suggested by various speakers as ways of meeting the difficulties commonly experienced in holding water-works employees. Both C. M. Saville of Hartford and S. H. Taylor of New Bedford said that their men were put at forest work to keep them on the payroll winters.

Old Steam Pumps at East Weymouth, Mass.—Two 1.5-m.g.d. duplex compound steam pumps—a Blake installed in 1885 and a Deane, two years later—were operated for 29 years, latterly under heavy overload, "and under better conditions for six years more, before serious trouble was experienced," stated Fred O. Stevens, engineer and superintendent of water-works at East Weymouth, Mass. Meters installed in 1915-16 relieved the strain and enabled one pump to handle the peak load, but in view of the low efficiency of the pumps it was not thought advisable to go to the expense of overhauling them. The war and subsequent high prices deferred letting a contract for new pumps and delay in delivery kept the old ones in service still longer.

In the spring of 1920 a high-pressure cylinder of the

Deane pump cracked. A previous re-boring of the cylinder had left "a scant ⅜-in. of metal." A new cylinder was obtained, some minor repairs made, the pump put in service, and a contract let for 1.5-m.g.d. motor-driven centrifugal pump. In August, before the new pump came, the "Blake pump, which was in better condition" than the Deane (although two years older) and was "our chief reliance," developed a crack in the suction chamber "just above the bed-plate flange." An electric welding company made a weld in place, although the drilling showed "that in places along the fracture there was only a scant ¼-in. metal." This strengthened the cylinder, but "it was neither water nor air tight." A form was built on the foundation, 4 in. from the suction chamber, and filled with hot asphalt to a line about 3 in. above the crack. In a few minutes the pump was started. About once a week it was necessary "to heat the casting and asphalt with a blow torch to get a new bond."

Shortly after this repair to the Blake pumps, a crack was found in the suction chamber of the Deane pump, in such a position as to necessitate tunneling up through the masonry foundation to get at it. Hot asphalt, applied to this crack with a brush, "helped matters considerably, but we were never able to get this pump running as smoothly as the other."

After having "crippled along" until December 1, the pumping engineer reported that the crack in the Blake suction chamber was "showing up on the other side." Hot asphalt was applied, and a temporary emergency pump located and installed. On taking the water end of the Deane pump from the foundation, a second and larger but previously concealed crack was found. The metal along the crack was planed down and tapped for numerous ¼-in. boiler-plate screws, after which a ⅜-in. steel plate, with rubber gasket, was attached. The repaired part was "absolutely tight under 100 lb. test pressure." The repairs cost less than $100. The pump was run during the following winter so as to use some coal left over after the new electric-driven pump was put in service.

Cross-Connections with Private Water Supplies—Under the title, "Use and Discard of Auxiliary Fire Protection from a Polluted Source," Caleb M. Saville, manager and chief engineer of water-works of Hartford, Conn., reviewed the use and final abolition of such connections in Hartford, even where double-check valves of the Factory Mutual type had been installed (see *Engineering News-Record* for 1921, July 7, p. 12, Sept. 8, pp. 390 and 409, Sept. 15, 464). Mr. Saville stated that Hartford, "so far as is known, was the first city to permit the installation of the double check-valve in lieu of complete severance of connections, and also, so far as is known, after a trial of 13 years, Hartford is the first city to order them out." Cross-connections, he stated, are now prohibited by Lowell and Springfield, Mass., Providence, R. I., Stamford, Conn., Philadelphia, Pa., Cleveland, Ohio, Terre Haute, Ind., and St. Paul, Minn., and by the state boards of health of Minnesota, entirely, and Illinois, on new installations.

Discussion: As usual at water-works conventions, this subject stirred up much discussion, and also, as usual, the water-works men were almost entirely and unqualifiedly against these cross-connections, while representatives of fire insurance interests raised the only voices in their support H. A. Burnham, engineer Factory Mutual Fire Insurance Companies, said that special double-check valves are required or approved by the New York and New Hampshire state, and the Ontario provincial boards, of health, and that few if any state health boards and not many cities have prohibited them; and that records show 600 installations of double check valves in 170 cities and towns in the United States. Mr. Saville, in closing, said that all the insurance interests except the Factory Mutual Companies are satisfied with some entirely independent source of water supply for fire protection, or a tank filled from the municipal system. The only advantage of the double check-valve controlled interconnection that he could see was that it costs less than an absolutely independent fire-protection supply, which is an alternative.

Other Topics—Pumping by electric power at Concord, Mass., with current bought at 1½c. per kw.-hr., is saving that city a considerable sum over the cost of steam power, according to a paper by P. R. Sanders, superintendent of water-works.

Arguments against merging water departments with other municipal departments, on the ground of resulting decreased efficiency through less efficient operation and sacrifice to other departments, were submitted in a paper by George A. King, superintendent of water-works, Taunton, Mass. (where apparently there is a proposal to put the water system under a board of public works). Most of those who discussed this paper supported Mr. King's arguments, but there was some expression of opinion that under a proper system of state utility or other state control water-works interests would be protected.

An entire session was devoted to papers on the "Water Supplies of Southeastern Massachusetts," by X. H. Goodenough, engineer, Massachusetts Department of Health, "The Water Supply of Fall River, Mass.," by H. K. Barrows, consulting engineer, Boston, and "The New Water Supply of Providence, R. I.," by Frank E. Winsor, chief engineer Providence Water Supply Board. The papers by Messrs. Goodenough and Barrows showed how closely related are the water problems of New Bedford, Fall River and Taunton, all of which draw from a group of natural bodies of water known as the Lakeville ponds. The construction of the core wall of the Wanaque dam was described by Major Arthur D. Pratt, chief engineer, North Jersey District Water Supply Commission.

A detailed review of "Court Decisions Incident to Purchase of the Braintree (Mass.) Water Supply Co.," in the eighties, was presented by Henry A. Symonds, engineer, Boston.

Under the title "Sanitary Dangers of Water Supplies," E. Sherman Chase, of Metcalf and Eddy, consulting engineers, Boston, outlined several instances of water pollution which, though relatively minor, point to the refinements in water protection and treatment beyond what seem to have been commonly regarded in New England as necessary.

A review of the use of copper sulphate to control algæ growths in the Hartford reservoirs was presented by J. E. Garratt, office engineer, with particular reference to the increase in the use of the slow sand filters put in operation a few months ago (described in *Engineering News-Record*, Sept. 7, p. 380).

An impromptu discussion at one of the sessions brought out the fact that the recent increase in the use of flushometers is leading to requests for larger supply pipes to water closets, particularly group installations, than has been the practice for closets flushed from tanks.

Ford Car Wrecks Steel Bridge

A rural mail carrier's Ford broke down a 75-ft. steel span over Beaver Creek, five miles northwest of Mulhall, Logan County, Okla., on Aug. 3. According to the available information, the wreck was not a floor failure but a truss failure. Ernest S. Alderman, state engineer, says that the bridge was an old structure, first erected eighteen or twenty years ago, and has been washed away several times. It was salvaged and repaired each time. When the accident occurred it had just been straightened in a blacksmith shop after a recent washout and had been re-erected.

A Logan County official in reporting on the accident stated that eighteen or twenty years ago the commissioners "bought a large number of very inferior bridges, and the Beaver Creek bridge is one of them. It was washed out several times, the last time about four months ago, and was rebuilt soon after that. Fortunately, there aren't any of the inferior bridges on our state roads."

Concrete Grain Elevator Rebuilt At Chicago

Extensive Repairs to Foundations and Bins of Structure Wrecked by Explosion—New Dust Removal Apparatus

REPAIRING reinforced-concrete grain bins damaged to varying extents by a grain-dust explosion was one of the difficult problems in the reconstruction of the 10,000,000-bushel Northwestern elevator at Chicago. This structure has a total of 277 bins 15 and 22 ft. in diameter and 97 and 104 ft. high. It represented a cost of about $5,000,000 including equipment and the damage was estimated at about $2,000,000. The elevator and the explosion were described in *Engineering News-Record* of March 31 and April 14, 1921, pp. 560 and 634; Nov. 3 and 24, pp. 719 and 847, and Feb. 22, 1922, p. 327.

Removal of the heaps of debris was the first task. Acetylene torches were used to cut apart the tangled wreckage of structural steel from the superstructure and the reinforcing bars of the damaged bins. Locomotive cranes then loaded the steel and the shattered masses of concrete onto railway cars. In Fig. 1 the new steel-frame car shed and drier house are completed and also the cupola on the bins of the working tower. These are of structural steel with tile walls. Some of the bin forms are shown in place. The new steel framing for the conveyor galleries over the bins is in place, as well as that for the marine tower or leg at the right. This tower is on the dock wall of the Calumet River.

Reconstruction Work—A special problem was to determine what parts of the structure could be utilized with safety and what parts would have to be demolished. Rectangular foundations or bases of plain or non-reinforced concrete built on the concrete base or mattress carry the cylindrical bins. About 50 per cent of these bin foundations were damaged more or less, as shown in Fig. 2. Many of them had been displaced bodily by the explosion and were jacked backed into position. These foundations were rebuilt according to the original plans.

Thorough inspections and tests of the bin walls were made to ascertain the relative strength of different portions, and in many cases it was found necessary to tear down standing walls on account of the evident damage done to the reinforcing. Cracks were examined carefully and enlarged where necessary in order to determine whether the reinforcing bars had been sheared. Sound tests were made on doubtful areas of wall by men lowered in rope slings and having heavy hammers.

Complete disintegration of the concrete of the bin walls was evident in a few cases where the grain had burned or smouldered in the bins for two or three weeks. This was due to the effect of the continued high temperature upon the concrete, which contained limestone aggregate. The walls heated to a high degree by these furnaces within the bins had been drenched with water by the fire engines, causing serious spalling. In such cases, the strength of both the steel and the concrete was under suspicion. In some of the bins of the river house where the lower part had been badly damaged or partly blown away (see Fig. 1) an interior shell or jacket of reinforced concrete slightly thinner than the original wall was built inside the bin, no allowance being made for any strength of the original wall.

Inspection showed that in most cases the damaged bins had been subjected to severe tensile stress, so that

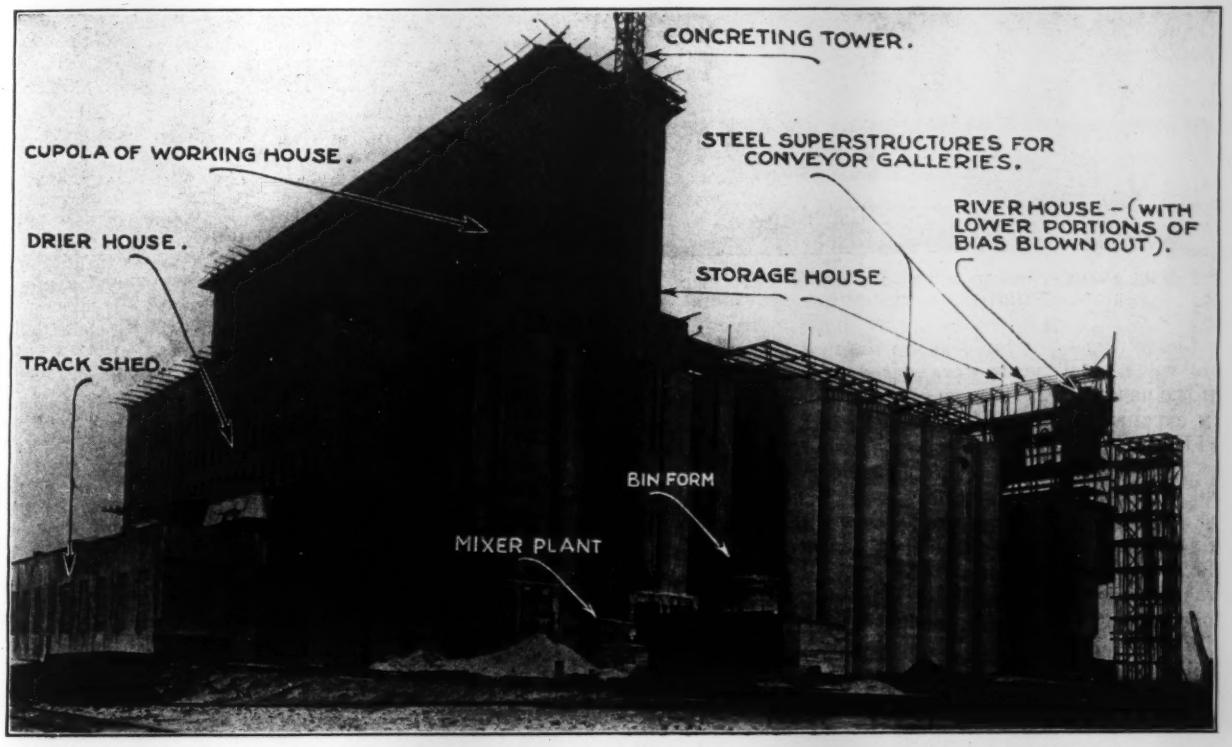


FIG. 1—RECONSTRUCTION OF NORTHWESTERN GRAIN ELEVATOR, CHICAGO

new reinforcing bars were required to supplement the original reinforcement. In cases where portions of the old reinforcement were utilized it was considered desirable to cut away enough of the concrete to expose the old bars for sufficient overlap with the new bars (see Fig. 2). Where the ends of old bars were left exposed and projecting by the removal of old concrete, laboratory tests were made on specimens to determine the quality of the steel.

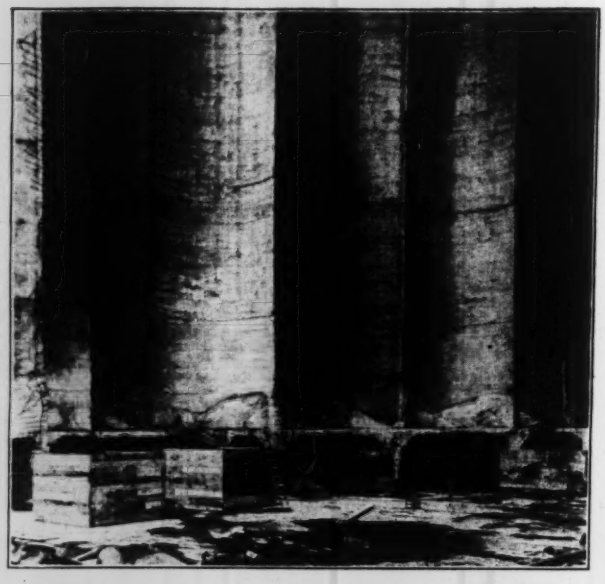


FIG. 2—SHATTERED BINS AND BASES CLEARED FOR RECONSTRUCTION

Concreting—For building up the new portions of the bin walls, steel forms were placed and concrete poured in the usual way. In some cases of small cracks caused by expansion of the reinforcement, it was necessary to widen the cracks by chisels to a width of several inches, so that the new concrete would bond properly with the old concrete and the steel bars. As tamping could not be applied in such cases the form was built up so as to give a head of concrete above the top of the opening, the excess concrete being afterwards cut off. No trouble was experienced in securing a good bond of the new concrete with the roughened surface of the old concrete.

For the heavier concreting, a large mixer was installed at the base of an elevator tower from which the concrete was spouted to the forms or to a hopper from which chutes or wheeled carts were loaded, as shown in Fig. 3. For patching the larger cracks several small portable mixers with gasoline engines were placed at the most convenient points and shifted as required. Concrete for the plain foundations was a 1:3:5 mix and that for the reinforced bins was 1:2½:4, the size of stone aggregate being 2½-in. and 1-in., respectively. Cement guns were used for closing the smaller cracks.

A thin coat of waterproof cement grout was applied to the interior and exterior surfaces in order to close minor cracks and to give a smooth finish and good appearance. Walls of 6-in. hollow tile were used for the cupola and track shed, which are of structural steel framing. These walls are coated with cement for the purpose of weatherproofing.

Dust Prevention—In the provision of new mechanical equipment special precautions are being taken to prevent a similar explosion in the future. One of the 11-ft. interstice bins in the middle of the storage section is converted into a ventilating shaft, through which fans will draw the dust-laden air from under the storage bins and force it out far above the roof. This shaft is shown in Fig. 3. Continual ventilation will be provided in the basement by placing the windows on tilting frames and by cutting large openings above the windows.

Since much dust ordinarily accumulates in the drier house a wide air shaft will separate the new drier house from the working house. With this arrangement both sides of the drier house can be opened and much of the dust blown out. Further, the house will be divided into twelve sections by partitions especially designed to isolate any explosion in one section. To eliminate the chances of heat due to friction from slipping belts, all drier fans will be driven by chains enclosed in dust-proof housings. A chamber between the east wall of the working house and the west wall of the storage bins,

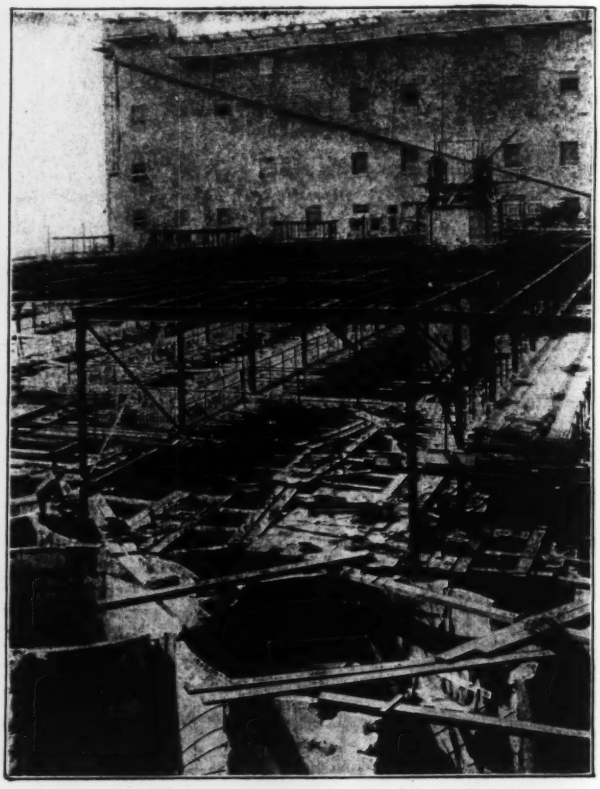


FIG. 3. REPAIR AND REBUILDING OF ELEVATOR

which was used formerly as a dust-settling chamber, will be converted into a ventilating shaft. It will have several large roof ventilators and will contain 20 of the cyclones of the dust-collecting system.

Two separate dust-collecting systems are being installed, each formed of separate units and each unit being operated independently. By one of the systems dust from all machinery and cleaning apparatus will be piped direct to twelve cyclone dust collectors on the roof of the track shed and twenty cyclones between the storage house and working house. Thence the dust will be carried to the collectors over dust houses outside the elevator. Fans will be connected to hoods which will be placed over all grain conveyor belts at the points of

delivery. Similar connections are made at the boots of all elevator legs. The other system will be a pneumatic dust-collecting system in two units to remove the dust from floors, walls and ceilings. This will have 408 inlet valves on 12,000 ft. of steel pipe varying from 2- to 6-in. in diameter and leading to four pneumatic collectors. Each of the two units will have two collectors. By this arrangement any grain picked up by the collecting hose will be salvaged by the first collector and the second collector will remove nearly all of the dust. This will allow clean air to pass through the vacuum producers.

To house the fans of the dust-collecting system, a specially designed fireproof building is to be provided outside the elevator. With the whole plant piped for compressed air, means will be at hand to blow dust out of motors and motor bearings. Every panel board throughout the plant is to be erected in a separate dust-tight room. All electric lights will be protected with double vapor globes and heavy wire guards.

The reconstruction of this elevator and the provision of additional dust-removal methods were designed by the John S. Metcalf Co., and the new concreting and installation of machinery was done by the Witherspoon-Englar Co., both of Chicago. These firms were respectively the engineers and contractors for the original structure.

To Improve Railway Terminals at Bombay, India

RAILWAY improvements planned and under way at Bombay, India, at an estimated cost of $35,000,000, include remodeling a large passenger terminal, building a new passenger terminal and a loop line, electrification of suburban lines and four-tracking of main lines. As shown in the accompanying map, two large railway systems enter the city and are connected with the railways and yards of the Bombay Port Trust, which is building new docks, grain elevators and other works. All tracks are on the Indian standard gage of 5 ft. 6 in.

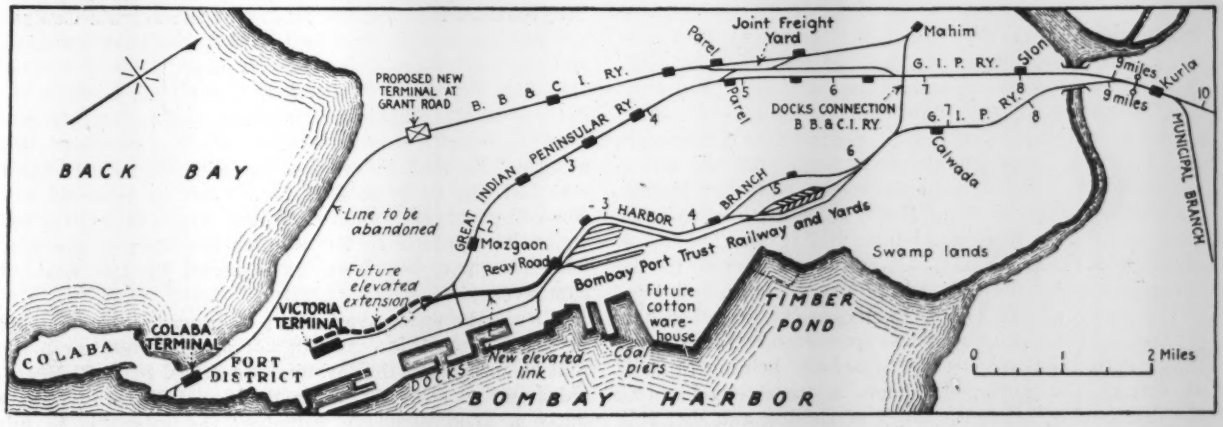
Loop Line and Elevated Terminal—Although the Great Indian Peninsula Ry. has four tracks for 32 miles the congestion due to increasing suburban traffic has led to the construction of a link connecting its harbor branch with the main line in order to complete a 9-mile loop or relief line. The old 6½-mile branch follows the east side of Bombay Island and terminates at Reay Road, where there is a connection with the dock railways. The new 2½-mile link extends from Reay Road across the city to the main line. Later, an elevated extension will continue this suburban line into the remodeled Victoria terminal station.

At present there are about 20 main line trains and 60 suburban trains in and out of this terminal daily, but with the opening of the loop line it is planned to operate a five-minute suburban service during the rush hours. Although the new line is intended mainly for electric suburban traffic its clearance limits provide for ordinary rolling stock and steam locomotives. Besides the suburban service, however, the line will give a direct route from the center of the city to the cotton warehouses and grain elevator now being built by the Bombay Port Trust in connection with the new docks.

Both the Victoria terminal and the Reay Road station are at street grade and as they are separated by the railway company's freight yards and dock branches it was necessary to build the new link at an elevation of 24 to 27 ft. Steep approach grades are required, 3 per cent for 812 ft. from the main line and 2.4 per cent for 1,150 ft. from Reay Road. The sharpest curve is 5½ deg. Most of the work is an earth fill between concrete retaining walls, with truss or plate girder bridges over the streets, but there are some rock cuts. Across the freight yards there will be 1,500 ft. of steel viaduct having 23 spans of 36 to 80 ft. The track will have 100-lb. bull-head rails in cast-iron chairs on wood ties.

Passenger Terminals—The Victoria station, a large and handsome structure, has ten tracks and seven high platforms, but in connection with the electrification it is planned to enlarge the station and provide seventeen tracks in two groups with a carriage driveway between them. The suburban group is to have eight tracks and the main-line group five, together with coach and freighthouse tracks. The seven-track approach will have two suburban and two through tracks for the main line, two for the harbor loop and a switching lead. The Bombay, Baroda & Central India Ry. now extends to an old terminal station on the water front at Colaba. Since this location is inconvenient it is proposed to build a new terminal station at Grant Road and to abandon the shore line or retain it only for local use.

Estimated costs of the several improvements are as follows: enlarging Victoria station, $2,350,000; new Grant Road passenger terminal, $800,000; electrification of all suburban lines, $18,800,000; shops for B., B. & C. I. Ry., $10,000,000; enlarging Mazgaon yard of G. I. P. Ry., $1,800,000; four-tracking main line of B., B. & C. I. Ry., $1,700,000.



BOMBAY RAILWAY IMPROVEMENTS

ENGINEERING LITERATURE

A REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

Repaying Scientific Obligations

One reason why Sir Alexander Houston's latest annual report on "The Examinations of London Water" deserves the commendation given it in a notice elsewhere in these columns is that in presenting and interpreting data the author goes beyond London. He says:

No hesitation has been felt in travelling beyond the range of purely Metropolitan Water Board affairs. As we borrow knowledge from others so ought we to try and repay our obligations. So far as the writer is concerned, his indebtedness to the work of other water authorities and other scientists is freely acknowledged. He ventures to think that in relation to questions of quality of water his board's views and policy in no way prevent him from exercising his individual judgment on all matters affecting the safety and purity of water supplies throughout the country, and adding what little he can to the sum of general knowledge of the subject.

This may be characterized as "repaying scientific obligations," a duty that might well be more generally recognized and fulfilled in public and other reports.

The Story of a Master Builder

E. H. HARRIMAN: A Biography in Two Volumes—By George Kennan. Boston: Houghton Mifflin Co. Cloth; 6 x 9 in.; pp. 842; illustrations. $7.50.

Unfortunately there are few worthy biographies of engineers. In large measure, therefore, the lay reader, who cannot be expected to seek out their stories in professional transactions and the technical press, must learn of their achievements by reading between the lines of conventional history or in the biographies of statesmen and business men. So we are grateful to Mr. Kennan for the generous credit he has accorded to the engineers associated with Mr. Harriman in his constructive work. Reading between his lines does not require a lens. Indeed, one need not seek between the lines, for he has set down the story so plainly that he who runs may read.

The readers of *Engineering News-Record* will be especially interested in three of Mr. Harriman's many works. These are the rehabilitation of the Union Pacific R.R., a similar service for the Southern Pacific, and the closing of the Colorado River break in 1907. In telling of these, the author tells of the work not only of the great railroad executive, but also of J. B. Berry, chief engineer of the Union Pacific, Horace G. Burt, president of that road and an engineer by profession, W. L. Park, superintendent of construction, Julius Kruttschnitt, general manager of the Southern Pacific, another engineer, William Hood, chief engineer of that road, and finally Epes Randolph, H. T. Cory, Thomas J. Hind, and C. K. Clarke, all of whom served in the struggle against the Colorado.

The story of the Union Pacific is the story of how a 1,000-mile streak of rust was converted in three years into a splendid transportation machine, helping to build an empire and paying dividends to its stockholders in the doing of it. It is the story of raising and spending in five years $45,000,000 for reconstruction and re-equipment, resulting in an increase in traffic density of nearly 60 per cent. It is the story of the Aspen tunnel, the 18-mile grade into Laramie, and of courageous and resourceful engineering of exceptional productive worth.

The rehabilitation of the Southern Pacific was similar in character but slighter in degree. As Western railroads went in those days, the road was in good shape when it was bought by the Union Pacific; but as the Central Pacific end of it from Ogden to San Francisco was required to complete the Harriman line to the coast he demanded that it be brought up to Union Pacific standards. This work required three years to complete and involved as one element the remarkable Lucin cutoff, carried for 27 miles directly across Great Salt Lake. Besides this, two other noteworthy cutoffs were built, the Bay Shore into San Francisco and the Montalvo in southern California. Altogether Harriman spent on the improvement of the Southern Pacific for extensions, betterments, new equipment, and other properties nearly $242,000,000. During his administration he spent on the two properties more than $400,000,000. And it paid.

The story of the Colorado flood is pitched in a different key. Meeting the flood was not a matter of thoughtfully planned engineering for business investment; it was rather a catch-as-catch-can, life or death struggle with a mad river bent on pouring a wave of desolation into a fertile valley, already the seat of a thriving community and smiling with promise of even greater wealth. The technical aspects of this engineering epic were presented in full before the American Society of Civil Engineers about nine years ago by H. T. Cory, one of the principals. Mr. Kennan has drawn freely on this and other sources and has succeeded in making the story of absorbing interest to the lay reader.

Other episodes that will interest the engineer as a live citizen concern Harriman's struggle with Morgan and Hill for control of the Burlington and with James R. Keene, who threatened his hold on the Southern Pacific. His beneficent relations with the Erie, his part in the Equitable Life Insurance squabble, his controversy with Stuyvesant Fish over the affairs of the Illinois Central, and his break with President Roosevelt all are recorded. But in controversial matters it must be remembered that Mr. Kennan is writing as a partisan, bent on the defense of Mr. Harriman's memory, and inclined to give him the benefit of every doubt. He has overdone this a little. No man so great as Harriman unquestionably was is likely to be so free from fault or error as this Boswell portrays his hero. But it would be ungracious to dwell on this since Mr. Kennan has been so generous when his pen has been untempered by the heat of controversy.

Within the space available it is impracticable to quote at length from this very stimulating book, but engineers will be interested in Harriman's counsel to J. B. Berry, chief engineer of the Union Pacific. "The only way to make a good property valuable," he said, "is to put it in the best possible condition to do business." To

which may be added the maxims that embrace to a considerable degree the Harriman gospel of railroad improvement: (1) "Develop railroads with cheap money." (2) "Never borrow from the substance of a road." The second maxim applies with peculiar force in these days of economies effected by deferring maintenance.

Masonry Structures and Foundations

REVIEWED BY A. BURTON COHEN
Consulting Engineer, New York City

THE DESIGN OF MASONRY STRUCTURES AND FOUNDATIONS—By Clement C. Williams, C.E., M.Am.Soc.C.E., Professor of Civil Engineering, University of Kansas; Consulting Engineer. New York: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. 555; 265 illustrations. $5.

The use of concrete has made possible large engineering works of a permanent nature which would have been prohibited in stone masonry because of an excessive cost, and in other building materials because of a lack of permanence. It is found applicable and used more or less in every branch of civil engineering. Therefore it is of paramount importance that the student and the beginner should be properly directed in the practical and fundamental considerations included in this phase of engineering. That these considerations can be presented in a simple, instructive and convincing manner to the student much in advance and independent of his theoretical studies and that his training should include a knowledge of and familiarity with the reliable and most recent sources of investigations tending to improve the art, are the first impressions gained in reading Prof. Clement C. Williams' new treatise on "The Design of Masonry Structures and Foundations."

The opening chapter, on general principles, includes a discussion of well chosen factors affecting design and æsthetics. The engineering student and worker should be imbued with an æsthetic appreciation; should know full well the fundamentals of proportion and architectural orders. There is no denying the fact that in the development of our modern structures a most remarkable improvement is found in architectural treatment. Even the layman feels the sense of beauty and in public works the taxpayer accepts his assessments willingly if local improvements admirably executed reflect credit upon the community.

Ugly lines, as Professor Williams states, are the result of improper design and proportioning which add a burden of waste. A simple example is the design of an arch ring with proper crown depth but having an excessive depth at the haunch; there is the importance, as described under masonry arches, of the full determination of the arch ring from crown to haunch. Excessive depth at the haunch decreases the effective rise of the arch, causing a greater overturning tendency on the pier or abutment where an increase of quantities adds materially to the cost of the structure. It is apparent that Professor Williams' experience has carried him far beyond the average reach of design; he has dealt in the finer elements of the subject that have engaged the attention of those concerned in extensive application. He has found that pleasing results can be obtained by graceful lines inherent with economic stability.

The author states that masonry constitutes the most permanent type of construction when properly designed to provide for both physical and economic conditions and points out some of the practical necessities to a full development. Mention is made of the all-important problem of waterproofing structures exposed to the disintegrating action of water. The membrane system for bridges is recommended as the most durable solution of this problem, which agrees with best accepted practice. The proper treatment of expansion and construction joints and drainage in connection with the above considerations control largely the affirmation of the term permanency in concrete construction.

Other chapters cover the subjects of walls, dams, bins and chimneys, falsework and foundations, in a clearly determined manner. The distribution of loads is treated under various subjects; for example, the effect of a surcharge live-load in the analysis of abutment and retaining wall design is discussed and also the distribution or spread of live-load through an earth embankment. As a rule these considerations so extremely important are not found discussed in textbooks. Concerning the question of loads: The ratio in amount of live- to the dead-load in concrete structures as compared with the same ratio in steel design permits a greater increase of live-load in design of concrete structures at comparatively little increase in cost—an economic factor which may govern the permanence of the structure, due to heavier duties of future demand. The preponderance of dead-load over live-load is more noticeable in railway than in highway structures and accounts for many old masonry structures carrying the heavy rolling stock of today that has caused so many renewals in steel structures. These are pertinent considerations that can be given to the student at any time, lending interest to his work and supplying a satisfaction, even to his inexperienced mind, that a knowledge of the facts are of engineering value.

The personal touch of experience and the simple and logical sequence of exposition pervading the entire treatise give exceptional value to Professor Williams' work. There is a possibility of a fuller development of many of the good angles of thought mentioned, but there are limitations placed upon a single volume covering so wide a field. Prepared for the student and worker, some repetition of theoretical analysis was necessary. Much has been previously written on this subject but new developments are rapidly taking place, making obsolete some practice of comparatively recent years and tending toward a more scientific treatment. There is a well earned place at present in the class room and in the library for Professor Williams' work dealing with the best current practice.

How to Use the Gantt Chart

THE GANTT CHART: A Working Tool of Management—By Wallace Clark, M. Am. Soc. M. E.; M. Taylor Society. With Appendices by Walter N. Polakov and Frank W. Trabold. New York: The Ronald Press Co. Cloth; 6 x 9 in.; pp. 155. $2.50.

The keynote of this book is sounded on the first page where the author says: "The Gantt chart, because of its presentation of facts in their relation to time, is the most notable contribution to the art of management made in this generation." The book is overlauditory. As many readers know, the Gantt chart shows very simply by horizontal lines the relation of the schedule of work to time, the work done each day in relation both to time and schedule and, finally, the cumulative work done and its relation to time and the schedule. It is the object of the author to explain the application and use of the chart in various ways. This he does in chapters on machine records, man records, layout charts, load charts, progress charts and

charting the American merchant marine. The book is a clear presentation of a simple and useful method of charting many operations.

Sir Alexander Houston's Latest Report

CHEMICAL AND BACTERIOLOGICAL EXAMINATION OF THE LONDON WATERS: Report for Year Ended March 31, 1922—By Sir Alexander Houston, Director of Water Examinations, Metropolitan Water Board. London: P. S. King & Son, Ltd. Paper; 8 x 13 in.; pp. 65; diagrams. 10s.

The reports by Sir Alexander Houston on the water supply of London have no equals in the water-works or in the entire municipal field. This is due not alone to the size of the London water-works, the character of the water drawn from the Thames, other rivers and from wells and the methods of treatment employed, nor even to these and the notable research work which these reports always chronicle. It is besides, and of more importance, the faculty of reviewing a year's routine and experimental work, tying it with the work of earlier years, and at the same time making it of value to the whole sanitary engineering world, which is possessed by Sir Alexander and by so few other officials in charge of large operations.

The high spots in the present report are Sir Alexander's earlier accounts of the continued chlorination of large quantities of raw water as a substitute for storage before filtration, thus saving last year well toward $100,000 worth of coal that would have been required, under the old plan, to pump the water to storage; "Some General Notes on the Future Chlorination of Water"; notes on applying chlorine to water, particularly chloride of lime; a resumé of further parallel experiments on rapid and slow sand filtration (both without coagulation); and comments on the typhoid, meteorological chemical and bacterial tables in the report.

Significant to Americans, and we hope to Britons as well, are the eight pages filled with Prof. Melville C. Whipple's summary and appreciation of Sir Alexander's report of last year (surveying fifteen years' work on London waters), which appeared in the *Journal* of the American Water Works Association for March of this year. With modesty, Sir Alexander says of Professor Whipple's paper: "Judged in its true perspective, Whipple's review is an appreciation of the Metropolitan Water Board, the [its] Water Examination Committee, and the Water Examination Department in the order stated. Sir Alexander gracefully adds: . . . "no country during the present century has done more than the United States to foster scientific research in every branch of Preventive Medicine." He also mentions Prof. George C. Whipple's Microscopy of Drinking Water" approvingly.

A Book for Steel Plant Men

HÜTTE: Taschenbuch fur Eisenhuttenleute—Herausgegaben vom Akademischen Verein Hütte. E. V. Berlin. Zweite Auflage. Cloth; 6 x 8 in.; pp. 963; 511 line cuts. 738 marks.

Under date of June, 1922, appears a second edition of this comprehensive handbook of steel mill construction, first issued as a separate volume in 1910. There are over 100 pages of entirely new matter. A new section, Plant Layouts, presents some elementary principles of civil and mechanical engineering and notes many precautions to be observed looking to economical management and operation. Other new portions are devoted to physical measurements, thermal characteristics of metals and furnace materials, sheet finishing mills, wire drawing and the manufacture of wire products. Naturally the book confines itself almost exclusively to German practice, but it contains a collection of widely scattered information of interest to engineers concerned with the construction or operation of steel works.

The Metric System in Practical Form

METRIC SYSTEM FOR ENGINEERS—By Charles B. Clapham Lecturer in the Engineering Department, University of London Author of "Arithmetic for Engineers." [The Directly Useful Technical Series.] New York: E. P. Dutton & Co. Cloth; 6 x 9 in.; pp. 181; diagrams. $6.

Those who may have to think simultaneously in terms of the English and the metric systems of measurement as a matter of daily occupation rather than of academic interest, will find this book useful and convenient. The relationship between the various English and metric units and combinations of units is shown by description, table and illustration. A distinctly practical feature is the use of every-day measuring tools in every-day operation to illustrate relative values in the two systems. Many practical examples are worked out completely. Bold face type has been used intelligently to emphasize the statements and units that have reference value. The several charts in the pocket at the end of the book enable direct conversion by inspection not only of the fundamental units of measurement, but also of many compound units commonly used in engineering work.

Tar and Its Uses

PREPARATION AND USE OF TAR AND ITS SIMPLE CRUDE DERIVATIVES—By W. W. Odell. [Prepared Under a Cooperative Agreement with the Illinois State Geological Survey and the Department of Mining Engineering of the University of Illinois.] Washington, D. C.: Bureau of Mines. Paper; 6 x 9 in.; pp. 84; illustrated. Limited number free on application; 15c. from Superintendent of Documents, Washington, D. C.

It seems strange that a Technical Paper (No. 268) "published by the Bureau of Mines as a general treatise on the utilization of tar," and containing details as to its use for roads, metal, roof and other paints, wood preserving, and cement for various purposes should omit one of the oldest and what is still one of the most important uses of tar—the coating of cast-iron pipe. This use is not entered in the index. The nearest approach to its mention in the text seems to be in the following sentence (p. 30): "Hot water-free tar is also used for painting underground iron pipes and for coating castings, pipe fittings, and metal roofs that are exposed to the atmosphere." This omission is all the more notable because the pamphlet, very properly, devotes much space to the use of tar in highway construction.

Summaries of Climatological Data

Climatological data for the United States from the establishment of the various stations to and including 1920 are being summarized by the United States Weather Bureau for publication in two volumes. Meanwhile, "Reprints" or preprints, are being made in 9½x12-in. pamphlet form, each covering relatively small sections of the country—as the Potomac River Basin, Central Illinois, Western North Dakota, etc. Temperature, precipitation, wind, humidity and frost data are given, some by months and some by averages, maxima and minima. In some cases stream discharges are included. There is a map for each district and occa-

sionally diagrams are presented. The compilation is made by P. C. Day, climatologist and chief of Climatological Division. Charles P. Marvin is chief of the Weather Bureau.

A Notable Water Power Installation

The hydro-electric power plant on the Aar River, known as the Goesgen plant, was described in an extended article in the *Schweizerische Bauzeitung* last year. The article has been reprinted by the contracting company known as "Motor," of Baden, Switzerland, as a pamphlet of 54 pages, large size, illustrated with line drawings and many half tones. The development, one of the most important in Europe, involved a large variety of engineering construction and equipment, so that any one interested in hydro-electric development would be rewarded by studying the description of the work as an example of modern European practice.

Long-Time Gage Heights of River Po

Daily gage heights of the River Po, at Parma, Italy, from 1820 to 1870, with records for 14 years scattered from 1824 to 1844 inclusive, are presented in a large pamphlet report ("Ufficio Idrografico del Po," M. Giondotti, Parma, Italy, director), published by the Reale Commissione per lo Studio del Regime Idraulico del Po. A brief introduction by the director is followed by daily records, with maximum, average and medium figures by months and years and some analytical tables.

Swedish Testing Institute Reports

The Government Testing Institute of Sweden ("Statens Provningsanstalt," Stockholm, Sweden), has issued a report entitled "Fire Tests on Building Constructions in England and Other Foreign States" and another on "Some Foreign Methods for Testing Heat Transmission Through Building Materials," each with illustrations.

Standard Act Enabling Cities To Zone

A standard form of enabling act for state legislatures to pass authorizing municipalities to frame and adopt zoning ordinances has been prepared by the Division of Building and Housing, Department of Commerce, Washington, D. C., and may be obtained free of charge on application.

PUBLICATIONS RECEIVED

[When possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale and the price is known by the editor the price is stated. Many of the pamphlets can be obtained without cost, or by inclosing postage. Persons who are in doubt as to the means to be pursued to obtain any publication listed should apply for information to the stated publisher, or, in case of books or papers privately printed, then to the author or other persons indicated.]

New Books and Revised Editions

AN INTRODUCTION TO THE STUDY OF LABOR PROBLEMS—By Gordon S. Watkins, Ph.D., Associate Professor of Economics, University of Illinois. [Crowell's Social Service Series.] New York: Thomas Y. Crowell Co. Cloth; 6 x 9 in.; pp. 664. $3 net; postage extra.

MACHINISTS' AND DRAFTSMEN'S HANDBOOK: Containing Tables, Rules and Formulas, with Numerous Examples Explaining the Principles of Mathematics and Mechanics as Applied to the Mechanical Trades. By Peder Lobben, Mechanical Engineer. New York: D. Van Nostrand Co. Flexible; 5 x 8 in.; pp. 487. $3.

MOSQUITO ERADICATION—By W. E. Hardenburg, Sanitary Engineer, Certified Member, American Association of Engineers. New York and London: McGraw-Hill Book Co. Cloth; 6 x 9 in.; pp. 248. $3.

SMELL, TASTE, AND ALLIED SENSES IN THE VERTEBRATES—By G. H. Parker, Sc.D., Professor of Zoölogy, Harvard University. Philadelphia and London: J. B. Lippincott Co. Cloth; 5 x 8 in.; pp. 192; 37 illustrations. $2.50 net.

TECHNICAL EXPOSITION: A Textbook on the Application of Exposition to Technical Writing, Designed for Students in Scientific, Agricultural, and Engineering Colleges—By Karl Owen Thompson, A.M., Associate Professor of English at Case School of Applied Science, Cleveland, Ohio. New York and London: Harper & Brothers. Cloth; 5 x 8 in.; pp. 227. $1.75.

TEXT-BOOK OF THE MATERIALS OF ENGINEERING—By Herbert F. Moore, Research Professor of Engineering Materials, Engineering Experiment Station, University of Illinois, Member American Society for Testing Materials, with a Chapter on Concrete by Harrison F. Gonnerman, Formerly Research Assistant Professor in Theoretical and Applied Mechanics, Engineering Experiment Station, University of Illinois, Member American Society for Testing Materials, Member American Concrete Institute. New York and London: McGraw-Hill Book Co. Cloth; 6 x 9 in.; pp. 315. $3.

A TREATISE ON PROBABILITY—By John Maynard Keynes. London: Macmillan & Co. Cloth; 6 x 9 in.; pp. 466. 18s. net. $6.

VECTOR CALCULUS WITH APPLICATIONS TO PHYSICS—By James Byrne Shaw, Professor of Mathematics in the University of Illinois. New York: D. Van Nostrand Co. Cloth; 6 x 9 in.; pp. 314; illustrated. $3.50 net.

Reports and Pamphlets in Various Fields

ECONOMICS OF HIGHWAY TRANSPORT: Proceedings of a Conference Called by the Highway and Highway Transport Education Committee, Held at the University of Maryland, College Park, July 27, 1921. Edited by C. J. Tilden. Washington, D. C.: Highway and Highway Transport Education Committee, Willard Building. Paper; 6 x 9 in.; pp. 51.

ELECTRICAL MACHINERY APPARATUS AND SUPPLIES—Fourteenth Census of the United States, Manufactures: 1919. Prepared under the Supervision of Eugene F. Hartley, Chief Statistician for Manufactures. Washington, D. C.: Department of Commerce.

FACTORS IN THE SPONTANEOUS COMBUSTION OF COAL—By O. P. Hood. Washington, D. C.: Bureau of Mines. Paper; 6 x 9 in.; pp. 9; 8 illustrations. Limited number of free copies; 5c from Superintendent of Documents, Washington, D. C.

FLEXURAL STRENGTH OF PLAIN CONCRETE—By Duff A. Abrams, Professor in Charge of Laboratory. (Authorized Reprint from the Copyrighted Proceedings of the American Concrete Institute, Vol. XVIII, 1922.) Chicago: Structural Materials Research Laboratory, Lewis Institute. Paper; 6 x 9 in.; pp. 25.

FOURTEENTH CENSUS OF THE UNITED STATES, 1920: Composition and Characteristics of the Population by States. Washington, D. C.: Bureau of the Census. Cloth; 10 x 12 in.; pp. 1253.

INDIAN STANDARD LOCOMOTIVES: 5 ft. 6 in. Gauge—By H. L. Cole, O.B.E., M.I. Mech. E., Locomotive Department. Indian State Railways, and Secretary, Railway Board. Calcutta, India. Paper; 9 x 13 in.; pp. 53; 63 charts. Rs. 5.

HAND BOOK OF THE ELECTRIC POWER CLUB—St. Louis, Mo., 1017 Olive St. Paper; 4 x 7 in.; pp. 286; line cuts. Standardization results accomplished by association of manufacturers.

THE LOADING OF FILTER PLANTS—Reprint from Public Health Reports, March 31, 1922. By H. W. Streeter, Associate Sanitary Engineer, United States Public Health Service. Washington, D. C.: United States Public Health Service. Paper; 6 x 9 in.; pp. 13.

THE PROSPECTS FOR BUILDING CONSTRUCTION IN AMERICAN CITIES—By Leonard P. Ayres, Vice-President, The Cleveland (Ohio) Trust Co. Paper; 6 x 9 in.; pp. 35; illustrated.

RECENT PROGRESS IN THE THAWING OF FROZEN GRAVEL IN PLACER MINING—By Charles Janin. Washington, D. C.: Bureau of Mines. Paper; 6 x 9 in.; pp. 34; illustrated. One copy free; 10c. from Superintendent of Documents.

USES OF DESCHUTES RIVER IN OREGON—Report to the Federal Power Commission by Board of Engineers: D. C. Henny, Consulting Engineer, U. S. Reclamation Service; J. B. Cavanaugh, Colonel, Corps of Engineers, U. S. Army; F. F. Henshaw, District Engineer, U. S. Geological Survey. Washington, D. C.: Federal Power Commission. Paper; 6 x 9 in.; pp. 90; illustrated.
An advance abstract of this report appeared in *Engineering News-Record*, Sept. 22, 1922; p. 503. Irrigation as well as water power is discussed.

WAGES IN FOREIGN COUNTRIES: Research Report, National Industrial Conference Board. New York: The Century Co. Paper; 6 x 9 in.; pp. 131. $1.50.
Among other occupations, covers building trades; mining; metal manufacturing; sand, glass and clay products; woodworking.

WOOD PRESERVING TERMS—By Ernest F. Hartman and E. F. Paddock. New York: Protexol Corporation, 34 Barclay St. Paper; 6 x 9 in.; pp. 85. $1.

LETTERS TO THE EDITOR

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Special Rod for Setting Slope Stakes

Sir—I have read with interest the article by Paul McCombs in the issue of *Engineering News-Record* for Aug. 24, 1922, p. 303, describing "Method of Setting Slope Stakes With Rod, Hand Level and Tape." I have set slope stakes by a similar method using a specially-graduated rod, which could be used in connection with the tape and wire extension described by Mr. McCombs.

The rod that I use has the naught marked at the height of the observer's eye and is graduated to read up and down from that point. The advantage of a rod so marked is that it simplifies the computations. Wherever the depth of the cut or fill, as the case may be, is less at the stake than at the center, the tape reading plus the rod reading will equal the cut or fill at the center. When cut or fill is greater at the stake than at the center, find the point on the slope where the tape reading equals cut or fill at the center plus rod reading.

G. F. WEBB.

Atlanta, Ga., Sept. 8.

Rivet-Hole Deduction and Tests

Sir.—The statement of Edward Godfrey in your issue of Aug. 31, p. 366, to the effect that tension tests on riveted joints have no bearing on the capacity of riveted tension members is somewhat puzzling in view of the fact that the critical section of a tension member is usually through the first rivets of an end connection. Whatever may be indicated by experimental investigation as the true net section through a tension splice should at the same time be the net section of a tension member with end connections similar to the splices tested, unless by chance the body details are unusually exacting. Mr. Godfrey himself, in Chapter IX of his book "Steel Designing," has indicated, indirectly at least, that end details ordinarily control the situation. Reference has already been made by Dr. Steinman and others to tests of tension details that should satisfy the designer of the essential correctness of the theory discussed in the bulletin to which reference was made in your issue of June 1.

Mr. Godfrey's tests (*Engineering News*, May 3, 1906, p. 488) appear to afford as much support for the theory which he criticises as for his own view.

Out of the first series of nine specimens tested, failure occured on diagonal lines in seven cases, indicating that the provision of a zigzag area equal to the right sectional area is not sufficient. The sectional area as calculated by Mr. Godfrey appears to be too great along diagonal lines. There is something wrong in the method of figuring deductions when drilled specimens of material with a strength of from 58,980 to 60,430 lb. per sq.in. give an ultimate strength of only 53,780 on the net section. Adopting the deduction rule criticised by Mr. Godfrey, this latter would for the drilled specimens of tests 1 to 9 be 58,000 lb.

Test specimens 10 to 18 do not properly represent structural members, in that $\frac{13}{16}$-in. holes in $\frac{3}{4}$-in. material (in some cases punched holes) are located with their centers $\frac{3}{4}$ in. from the edge of the specimens. The closeness of the holes to the edges would tend to bring about early failure of the narrow strip of metal along the edge at each of the outer rivets and thus produce a high eccentricity on the whole specimen. Mr. Godfrey states that a hole on one side of a bar weakens it much more than one on the center, and it is reasonable to suppose that the greater this eccentricity, the greater the weakening effect would be. The fact that there was only one diagonal failure out of nine in tests 10 to 18 suggests some peculiarity of this series, since there appears to be no reason, if such peculiarity did not exist, why as large a percentage of diagonal failures should not have taken place in this series as in tests 1 to 9. The marked smallness of the ultimate stress compared with that realized in tests 1 to 9 leads one to the conclusion that the nearness of the holes to the edge is a special weakening factor.

Comparison of the low stresses reported by Mr. Godfrey for tests 28 to 36 with the known value of the material suggests that the deduction has not been correctly made. If it be made on the basis of the theory outlined in the writer's pamphlet, the stresses would then be increased 14 per cent as compared with Mr. Godfrey's. These stresses would then correspond very closely to those realized in tests 19 to 27, with the exception of the specimens with punched holes, which necessarily produce highly irregular results. The correspondence for the drilled and reamed specimens is very close, as should be the case since there is no eccentricity involved in specimens 28 to 36.

C. R. YOUNG,
Associate Professor of
Structural Engineering,
Toronto, Sept. 7. University of Toronto.

Herodotean Hydrology

Sir:—Some of your readers may enjoy the following article on a hydrological subject written about twenty-three and one-half centuries ago. Herodotus, the Greek traveler and historian, was the author.

"Perhaps, after censuring all the opinions that have been put forward on this obscure subject, [The Inundation of the Nile] one ought to prove some theory of one's own. I will therefore proceed to explain what I think to be the reason of the Nile swelling in the summer-time. During the winter the sun is driven out of his usual course by the storms, and removes to the upper parts of Libya. This is the whole secret in the fewest possible words; for it stands to reason that the country which the Sun-god approaches the nearest, and which he passes most directly over, will be scantiest of water, and that there the streams which feed the river will shrink the most.

"To explain, however, more at length, the case is this: The sun, in his passage across the upper parts of Libya, affects them in the following way: As the air in those regions is constantly clear, and the country warm through the absence of cold winds, the sun in his passage across them acts upon them exactly as he is wont to act elsewhere in summer, when his path is in the middle of heaven—that is, he attracts the water. After attracting it, he again repels it into the upper regions, where the winds lay hold of it, scatter it, and reduce it to a vapor, whence it naturally enough comes to pass that winds that blow from this quarter —the south and southwest—are of all winds the most rainy. And my own opinion is that the sun does not get rid of all the water which he draws up year by year from the Nile, but retains some about him. When the winter begins to soften, the sun goes back again to his old place in the middle of the heaven, and proceeds to attract water equally from all countries. Till then the other rivers run big from the quantity of rain-water which they bring down from countries where so much moisture falls that all the land is cut in gullies; but in summer, when the showers fail, and the sun attracts their water, they become low. The Nile, on the contrary, not deriving any of its bulk from rains, and being in the winter subject to the attraction of the sun, naturally runs at that season, unlike all other streams, with less burden of water than in the summer time. For in summer it is exposed to attraction equally with all other rivers, but in winter it suffers alone.

"It is the sun, also, in my opinion, which, by heating the space through which it passes, makes the air of Egypt so dry. There is thus perpetual summer in the upper parts of Libya. Were the position of the heavenly bodies reversed, so that the place where now the north wind and the winter have their dwelling became the station of the south wind and noon-day, while on the other hand the station of the south wind became that of the north, the consequence would be that the sun, driven from mid-heaven by the winter and the northern gales, would betake himself to the upper parts of Europe, as he now does to those of Libya, and then I believe

this passage across Europe would affect the Ister exactly as the Nile is affected at the present day. And with respect to the fact that no breeze blows from the Nile, I am of the opinion that no wind is likely to arise in very hot countries, for breezes love to blow from some cold quarter."

Urbana, Ill., July 31. M. L. ENGER.

Determining Rail Wear

Sir—My attention was recently called to the article on "Determination of Rail Wear for Valuation Purposes," by J. P. Newell, which appeared in the issue of *Engineering News-Record* for August 24, 1922, p. 310.

While very interesting and constructive, the article starts out with a probably unintentional misstatement of fact, as follows: "The difficulty of accurately measuring the wear of rails in the track has hitherto made the inspection of rails in valuation work almost entirely a matter of the judgement of the inspector. In the Grand Trunk arbitration, with ten thousand miles of track to be examined for actual purchase, a more definite method of procedure was desirable. It was made possible by the invention of a rail pantograph by S. W. Fairweather, office engineer of the government staff."

Anyone not otherwise informed, on reading the above statement would naturally infer that the measuring of rail wear by mechanical means was a matter of only recent endeavor, when as a matter of fact, the method described in this article has been in use for the past 15 years or more to the undersigned's personal knowledge.

For years past, several of our larger engineering instrument manufacturers have manufactured and sold "railographs" that have been in practical use for this purpose since 1906 or 1907, and possibly earlier. These earlier railographs were designed for measuring T-rail sections and were not then adaptable for the wear of the girder grooved-rail of the street railway. Since then, however, railographs or pantographs, whatever they may be called, have been designed to measure this girder grooved and other special street-railway rail.

Baltimore, Md., Sept. 11. ROBT. B. RIFENBERICK.

Louisville Sewer Specifications

Sir:—The article in *Engineering News-Record*, Aug. 17, 1922, p. 268, concerning the Louisville sewer specification controversy, indicates the results that may be expected when the principles of the law of contracts are disregarded. Generally speaking, contractors are better informed concerning such laws than are the engineers who prepare the specifications and such other documents which go to make up the complete contract. Clauses which the law will not enforce, are worthless, and are better omitted from the specifications and contract. The following analysis will serve to show the general principles upon which most of the changes and revisions asked for can be supported:

1. The clause (in the issue above noted) headed "Engineer to Decide," is faulty and cannot be enforced; since it is the plain intent of the clause to deprive the courts of jurisdiction, and to also deprive the parties of their right to action. The courts will not delegate their authority and any agreement to waive the right to action will not operate to change the law in this respect, and either party is entitled to sue the other for damage at its option.

2. Any arbitration clause that it is possible to write which gives the power of *absolute* settlement of dispute to any other than the courts having jurisdiction is likewise void. The arbitration clause may, however, be so worded that arbitration may be a condition precedent to the right to action by either party and the law will sustain such a clause. However, after being unable to agree by arbitration either of the parties may enter suit against the other.

Nearly every contract is changed more or less during the execution of the work. This may or may not give rise to differences of opinion. In nearly every case the final settlement involves an adjustment of these differences that is satisfactory to both parties. Such an adjustment may be taken, then, as a modification of the original contract. A memorandum of such adjustment and balancing of claims should, however, be made a matter of record, so that any one, at any time, can determine just what was done, and why. Such action is purely arbitration, and only becomes binding and final upon being assented to by both parties. While this is the right of either party, the law generally favors a peaceful settlement, and would probably sustain the awards made by a properly conducted arbitration.

3. The condition of the part of the clause which makes the engineer, who is obviously the agent of the commission, the higher court relative to the interpretation of his own plans and specifications, acceptability of material and character of workmanship required, is good, since he is plainly the better qualified to pass upon these things than are others; and little difficulty will be encountered in the operation of such a clause, if the engineer will specify clearly and definitely what is wanted and the standards to which such material and workmanship shall conform to be acceptable.

4. At first sight it would seem strange that the contractor should object so strenuously to provisions which he knows very well cannot be enforced; but he also knows that should the commission believe that the conditions were enforceable and could be sustained, that there could be no contract, as the parties could not have assented to the provisions of the contract in the same sense.

5. The part of the clause, "his estimate and decision shall be final and conclusive to both parties to the contract," is likewise faulty, since it is clearly the right of either party to inquire into the accuracy of any estimate, final or otherwise, that he may have cause to question. This clause, relating specifically to amounts of work done, is generally used. Engineers are usually honest enough so that neither party would be harmed by the operation of such a clause; and such a clause could only be made void by proving that the engineer had acted fraudulently in the matter, or was morally deficient, which would be a rather hard case to prove, as a general thing. It is the plain duty of the engineer to correct any error of whatever nature which he may have made in the preparation of his estimates.

6. Relative to the "points at issue," as listed under that caption, most of them can be justified by two other conditions in the law of contracts, nemely: (*a*). The contractor is required to protect himself by contract from contingencies that may arise in the prosecution of the work, and will be held to do anything which may reasonably be done by any one, in the performance of the work, as distinguished from the contractor's individual ability to perform such work. (*b*). The remedy for damage is compensation. Hence, if after the plans and specifications, which may have been not in accord or ambiguous, have been interpreted by the engineer, the contractor finds that he has estimated on construction work materially cheaper than what he is now required to build he is entitled to extra compensation therefor, and the courts will award it. The reverse is also true.

The above is given in order to show clearly the necessity of a clear understanding of the law of contracts when writing documents for the work which go to make up the complete contract for that work.

Port Huron, Mich.

BENJ. L. PARKER,
Resident Engineer,
St. Clair County Road Commission.

Paraffin and Poisons for Wood Preservation

By impregnating paraffin with iodine of arsenic, iodine of copper or other poison and injecting the mixture into wood Dr. Paul Bartsh of the Smithsonian Institution claims that the wood will be preserved indefinitely against all kinds of destructive organisms. *The National Lumber Bulletin* reports that investigators at the Forest Products Laboratory have shown that the new treatment will not cost any more than the present treatments and that the paraffin penetrates wood more readily than do the preservations now being used.

NEWS OF THE WEEK

New York, September 21, 1922

Kansas Cement Companies Pay Large Fine

Enjoined Against Trade Restraint and Pay $25,000 in Judgment Following State Attorney's Action

Seven cement companies operating in the State of Kansas have paid a fine of $25,000 and have agreed to a judgment enjoining them against certain practices in restraint of trade charged by the Attorney General in an action begun July 14, 1919. The official statement of the case is as follows:

The case of the State of Kansas, on relation of Richard J. Hopkins, Attorney General, as plaintiff, against the Ash Grove Lime and Portland Cement Co., the Bonner Portland Cement Co., the Fredonia Portland Cement Co., the Great Western Portland Cement Co., the Lehigh Portland Cement Co., the Monarch Cement Co., and the Western States Portland Cement Co., defendants, was begun in the Supreme Court of Kansas, July 14, 1919. The petition charged that the defendants had formed, and were conducting an agreement in restraint of trade by fixing prices and terms for the sale of cement at wholesale in the state.

The defendants denied the allegation of the petition in regard to forming or performing an agreement in restraint of trade.

TESTIMONY BEFORE COMMISSIONER

The state moved the court to appoint a commissioner to take testimony and make a report to the court of the facts found and his conclusions of law upon them. The defendants then moved the court that instead of appointing a commissioner, the state be required to file written interrogatories addressed to the defendants, and that the defendants be directed to answer them. The court deferred the appointment of a commissioner, and made an order requiring the filing of the interrogatories and answers. The state filed 189 written interrogatories to bring out information from the defendants on the questions involved, and the defendants filed answers, and on the insistence of the state that the answers were incomplete, the defendants filed supplemental answers.

The state next renewed its motion for the appointment of a commissioner and the court appointed Z. T. Hazen of Topeka. Much evidence was introduced before him by the state.

The defendants then indicated to the state a willingness to agree upon a judgment, and a stipulation was made between the parties for the entry of a judgment against the defendants. This judgment was entered, pursuant to stipulation of the parties, on Sept. 5, 1922. It provided, in brief, that the defendants should, within twenty days, pay into the state school fund $25,000; that they should pay the costs of the suit including the fee of the commissioner, and they were enjoined from

(Continued on p. 494)

Settlement Terms of Rail Strike

With the exception of about half a dozen of the large railways—including the Pennsylvania, D., L. & W., Delaware & Hudson and C. R.R. of N. J.—the carriers have accepted the terms which the striking railway shopmen submitted last week as a basis for individual settlement. The chief points in the agreement are summarized below:

All men to return to work in positions of the class they originally held on June 30, 1922, and at the same point.

Relative standing, as between themselves, of men returning to work and men laid off to be restored as of June 30, 1922.

Disputes as to relative standing and other strike controversies to be decided by majority vote of a commission to consist of six representatives of the labor organizations and six representatives of the railroads.

All pending law suits resulting from the strike to be withdrawn.

To Stabilize Coal Industry

With the support of Secretary of Commerce Hoover the Chamber of Commerce of the United States has begun a campaign to stabilize the coal industry and prevent a recurrence of present conditions caused by the strike. The program contemplates methods of equalizing and expediting the distribution of coal and of preventing soaring prices. Regulatory legislation will not be urged on Congress.

Decayed Trestle Cap Wrecks Bridge and Kills Eighteen

A motor truck loaded with men going to a ball game broke through a bridge over the Satilla River, three miles from Axson, Ga., on Sept. 11. Eighteen of the 32 passengers were killed. Searcy B. Slack, bridge engineer of the State Highway Commission, gives the following statement of the circumstances:

"The bridge, located on a secondary county road, was a wood trestle 150 ft. long with a 30-ft. A-frame span over the channel. The roadway was 12 ft. wide. The structure was of hewn timber and the wood floor was quite irregular.

"A 2½-ton Indiana truck carrying 32 negro men drove on the bridge at a speed estimated at 25 miles per hour, and crashed through the 30-ft. channel span. The failure apparently was due to a rotten bent cap at the south end of the channel span. All timber of this span fell into the river.

"The bridge was posted at the ends with a sign reading 'Dangerous to Cross with Heavy Load.' The accident thus illustrates the ineffectiveness of the practice of posting bridges."

Hetch Hetchy Work Shows Uniform Progress

O'Shaughnessy Reports 2,100 Men at Work on San Francisco Water Supply Project

M. M. O'Shaughnessy, city engineer of San Francisco, returned Aug. 24 from an inspection trip over the Hetch Hetchy project and reported good progress all along the line with a total of about 2,100 men at work and every prospect for completing the mountain division and developing power within two years.

On the main dam 253,000 cu.yd. of concrete out of a total of 376,000 cu.yd. had been poured. Over 40,000 cu.yd. were to be poured during August, leaving 80,000 yd. to complete the structure. In the 18-mile tunnel 74,244 ft. were driven, leaving 22,710 ft. to go.

In the Priest earth dam which will serve as a forebay for Moccasin Creek power house and which is located at the lower end of the 18-mile tunnel, 6,700 cu.yd. of concrete had been placed in the core wall and earth was being delivered to the dam at the rate of 40,000 cu.yd. per month. The completion of the structure was expected within fifteen months.

TUNNEL ADVANCED

In the 6,000-ft. tunnel from the forebay to the upper end of the Moccasin Creek penstock line an advance of 262 ft. had been made at the reservoir end and the other portal was soon to be started. Foundation for the three penstock pipes was being prepared by a crew of about 130 men. Contracts had been awarded for generators and water wheels in the Moccasin Creek power house and satisfactory bids had been received for the switchboards. All power house equipment is to be delivered and installed within a year.

The construction of the Don Pedro Dam just below the Moccasin Creek site will make necessary the relocation of the Six-Bit Gulch trestle on the Hetch Hetchy R.R. Contracts for a new steel crossing have been awarded, excavation is now being made for piers to be 55 ft. high, and the new structure will be completed in four months. Eight hundred feet of the main Hetch Hetchy aqueduct just below Moccasin Creek power house will also be submerged by the water impounded behind Don Pedro Dam and bids are to be received at an early date for completing this work before the Don Pedro reservoir is filled.

The 20-mile section of the aqueduct in the San Francisco Bay division which is now under construction to supplement the present Spring Valley source of supply, is also to be completed within two years. Work has been started at both portals of Pulgas tunnel, 8,600 ft. long, near Redwood City, for which a $700,000 contract was recently let, and final studies are being made on the submerged pipe line to be laid across San Francisco Bay near Dumbarton.

Thomas B. Bryson

Career of Prominent Contractor Marked by Large and Difficult Construction Projects

Thomas B. Bryson, vice-president of the Holbrook, Cabot & Rollins Corp., whose death in New York on Sept. 5, was noted in last week's issue of this journal, was born in Mechanicsburg, Pa. He was graduated from Cornell in 1894 with the degree of C. E. and was first employed by the Pencoyd Iron Co. of Philadelphia as draftsman.

He left this company after about a year to become associated with J. W. Hoffman, where he obtained his early experience in the contracting business, being employed on heavy railroad construction and harbor work. He came to New York about 1900 and specialized in foundation and pneumatic work with the John F. O'Rourke Co. He was in active charge of a number of difficult foundation jobs, amongst which was the foundation for the Stock Exchange Building in Wall Street. About 1905 he started in contracting on his own account, specializing in foundation and tunnel work. During this period he constructed one of the sections of the Fourth Ave. subway in Brooklyn, adopting some original methods with great success.

Drydock Construction Difficult

In connection with the Holbrook, Cabot & Rollins Corp. he took a contract for the completion of Dry Dock No. 4 at the Brooklyn Navy Yard, a particularly difficult piece of work which had been in process for six years or more. Mr. Bryson sank a series of caissons through rock around the entire limits of the dry dock and three lines of caissons under the floor. The contract was successfully completed well ahead of the specified date.

Another contract in connection with the Holbrook, Cabot & Rollins Corp. was the section of the Catskill Aqueduct Tunnel from Cooper Union, New York, under the East River to Brooklyn. This was a 16-ft. bore through solid rock, reaching a depth of 750 ft. below sea level. Other pieces of construction work that he took in connection with Holbrook, Cabot & Rollins Corp. were pneumatic foundations, Public Service R.R. terminal, Newark, N. J.; pneumatic shafts, New York side, New York, New Jersey vehicle tunnel; pneumatic foundations, New York Telephone Building, Fulton St. and Broadway, New York City; pneumatic foundation work, First National Bank Building, Jersey City, N. J.

At the time of his death he was constructing foundations for the piers and abutments of the new bridge from Philadelphia to Camden. This job involved the sinking of two of the largest caissons that have ever been built.

Mr. Bryson was an associate member of the American Society of Civil Engineers, and had been president of the General Contractors Association of New York. He was recognized as having preeminent ability in foundation work from a technical standpoint, and was distinguished also by his ability to organize and handle men. He obtained not only the hearty co-operation of his associates, but also a high degree of loyalty and friendship.

Maurice B. Greenough to Enter New Field Jan. 1

Maurice B. Greenough, who for the past five years has been with the National Paving Brick Manufacturers Association, three years of which he has served as its secretary, is to become associated on Jan. 1, 1923, with M. Lasley of Chattanooga, Tenn., who controls very extensive interests, including the manufacture of paving brick and a road and pavement contracting company. Mr. Greenough became associated with the National Paving Brick Manufacturers Association in 1917, when he was made chief engineer. The next year he was made assistant secretary and in 1919 elected secretary-manager.

Mr. Greenough was born in Groveland, Mass., and received his early education in that town, graduating from the High School in 1908. He was graduated from Tufts College with a degree of Bachelor of Science in Civil Engineering in 1912. The year of his graduation he became associated with Winston Co., contractors, in the construction of the Ashokan reservoir for the N. Y. water supply, being stationed at Brown Station, N. Y. The following year he was appointed an instructor in mechanical engineering at the Rhode Island State College at Kingston, but soon left to serve five years as instructor in civil and highway engineering in the Case School of Applied Science.

Mr. Greenough is widely known among technical men and manufacturers of construction materials. He is an associate member of the American Society of Civil Engineers and of the American Society for Municipal Improvements and a member of the American Ceramic Society, the American Trade Association Executives, The Cleveland Engineering Society, The Illinois Society of Engineers, The Ohio Engineering Society, and The Wisconsin Engineering Society.

Duff Is New Secretary of Paving Brick Association

Edward E. Duff, Jr., of Pittsburgh, was appointed Sept. 15 secretary of the National Paving Brick Manufacturers' Association to succeed Maurice B. Greenough, whose resignation effective Jan. 1 is noted elsewhere in these columns. Mr. Duff is a civil engineer graduate of Carnegie Institute of Technology, class of 1913. After two years' service in the engineering department of the Pennsylvania R.R., he served as borough engineer and building inspector at Sewickley, Pa., where he was in charge of extensive grade-crossing eliminations, paving and other municipal activities. As a lieutenant and a captain, Engineers, during the World War he served with the A.E.F. in France. In 1919 he joined the field organization of the Eastern Paving Brick Manufacturers' Association as district engineer for the Western Pennsylvania territory.

Bill to Block Coal Profiteering Goes to President

Washington Correspondence

With the approval of the conference report on the bill intended to prevent profiteering in coal and providing for the control of distribution, the measure was sent to the White House. The signature of the President probably will be affixed and the bill become a law this week. Only twelve votes were cast in the Senate against the conference report on this bill, despite the fact that it was vigorously opposed by such influential members as Minority Leader Underwood and Senator Sutherland, of West Virginia.

Senator Underwood contended that the government can not undertake to regulate the prices of commodities every time the price level exceeds that which commonly is regarded as fair. One of Senator Underwood's objections to the legislation is that it does not reach the profiteer but concentrates its penalties on the consumer.

Senator Sutherland, in the course of his remarks, said: "This situation will cure itself in a very short time insofar as soft coal is concerned. The entire difficulty would be solved more readily if the transportation companies and the shippers were authorized to proceed to get this coal to the market in the usual manner, according to methods that have been adopted after many years of trial and experiment."

Senator Reed, of Pennsylvania, among other things said, asserted that if the bill is approved "every time anything goes up in price, and some people wish to get it cheap, they will come rushing again to Congress to fix the prices."

Advocates of Ford Muscle Shoals Offer Seek Vote on It in House

Washington Correspondence

Proponents of the Ford offer for Muscle Shoals are awaiting an opportunity to have the Detroit manufacturer's proposition brought to a vote on the floor of the House. In view of the legislative situation, it will require a special rule to bring this issue up and such a rule admittedly will be difficult to obtain.

While the general plan of procedure of the Ford advocates has been placed in the hands of Representative Garrett of Tennessee, acting minority leader, the assistance of a number of Republican members who have displayed keen interest in this subject is available.

Representative Garrett has no definite plan thus far. In discussing the matter he stated that his tactics would consist of waiting for an opportunity to move on the floor for instructions to the rules committee and of seeking an opportunity to urge the subject upon the rules committee, of which he is the ranking minority member.

Chairman Campbell, of the rules commmittee, is understood to be opposed to the Ford offer and the majority of that committee do not appear to be favorable to it. Added to this disadvantage from the viewpoint of the Ford advocates in the fact that the steering committee, which has great influence with the rules committee in determining the precedence of legislation for the consideration of the House, has refused to exert pressure in behalf of the Muscle Shoals bills.

San Francisco Votes First Money on Transbay Bridge Project

The San Francisco Board of Supervisors on Sept. 5 voted a sum not to exceed $225,000 for surveys and rights-of-way on the San Francisco-San Mateo County highway to connect the city with the proposed highway bridge across the lower end of San Francisco Bay. On the same day San Mateo County supervisors voted their share of $20,000 toward the work. Sufficient funds for all the preliminary work are now available. The total cost of the new highway when completed is to be about $4,000,000.

Cement Companies Pay Fine

(*Concluded from p. 492*)

maintaining or carrying out the terms of an agreement with Hiram Norcross for the maintenance of a joint bureau and from making or carrying out any agreement for fixing prices and terms of the sale of cement at wholesale within the state.

A copy of the body of the judgment is set out as follows:

TEXT OF JUDGMENT

"It is ordered, adjudged and decreed that judgment be rendered enjoining said defendants from forming, continuing or maintaining a trust or combination of the capital, skill and acts of the defendants, or any of them, for the purpose of creating or carrying out restrictions in trade and commerce, including among other things, the sale of cement within the State of Kansas; from carrying out restrictions in the full and free pursuit of the business of selling cement at wholesale in the State of Kansas; from agreeing to maintain, fix or increase the price of cement within said state; from fixing among themselves a standard of figures whereby the price of cement sold to the public within said state shall be controlled or established; from making, entering into, executing or carrying out any contract, agreement or obligation by which the defendants have bound or shall bind themselves not to sell or deliver cement below a standard figure or to keep the price of cement at a fixed or graded figure; from establishing and settling the price of cement between themselves; from precluding or preventing a free and unrestricted competition among themselves and others in the sale of cement in said state; from agreeing to sell and deliver cement within said state at uniform or substantially uniform prices fixed by the above named defendants; from unlawfully suggesting, advising or stating to each other, directly or through their officers, agents, or employees, the prices at which cement shall be sold by any of the above named defendants within said state; from doing any acts or making any statements to preclude or prevent competition in the sale of cement and the prices on the sale of cement in said state; from making, carrying out, continuing, maintaining or doing any contract, agreement, obligation or act to accomplish any of said purposes or acts enjoined as aforesaid; and from carrying out, continuing or maintaining an agreement between the defendants, or any of the defendants, or between them, or any of them and any other person or persons, of the terms set forth in the attached form of agreement with Hiram Norcross under the name Norcross Audit and Statistical Bureau.

"And that the defendants above named, pay to the State Treasurer of the State of Kansas, for the benefit of the permanent school fund of said state, the sum of $25,000, within twenty days from this date, and that said defendants, according to said stipulation, shall also pay the costs of this action, including an allowance of $4,000 to Z. T. Hazen, commissioner, for his services and expenses and the services and expenses of his reporter."

The Engineer in Public Life

PAUL DOTY

Paul Doty, chairman of the Minnesota Board of Registration for Architects, Engineers and Land Surveyors, has accepted the Democratic nomination for member of Congress from the fourth district of Minnesota, which contains the city of St. Paul. He was graduated from Stevens Institute of Technology, Hoboken, N. J., in 1888, with the degree of mechanical engineer. For a number of years preceding the war he was vice-president and general manager of the St. Paul Gas & Light Co., which position he resigned after the United States entered the World War to accept a commission as major, Engineers, U. S. Army. He was placed in charge of the utilities department at Camp Grant, Ill. Later he was transferred to Washington and placed in charge of utilities for all posts and camps, with rank of lieutenant-colonel.

Col. Doty is a director of the Minnesota Federation of Architectural and Engineering Societies, and president of the St. Paul Association of Public and Business Affairs, the local Chamber of Commerce. He has practically worked out of straight engineering into executive, financial and public lines. He is a director of the St. Paul Trust and Savings Bank, in charge of investments, mortgages and appraisal work. As president of the St. Paul Association he has endeavored to secure for the city the use of the water power now going to waste at the "high dam" in the Mississippi and has helped to secure from Henry Ford the promise of opening a manufacturing plant in St. Paul if the water power can be obtained.

Col. Doty has spent considerable time in Washington looking after these and other matters affecting St. Paul, and it was thought by the business interests in general that it might be well to place him in Washington permanently. The opportunity came when the nominee of the regular Democratic convention, a former mayor of St. Paul, resigned on account of ill health. Party lines will probably be abolished in the forthcoming election, it is predicted, for Col. Doty has the support of all the daily newspapers.

New England Water-Works Men Hold Convention at New Bedford

Two-score technical papers on a variety of topics, an automobile trip and lunch tendered by the New Bedford Water Board, a boat ride and clam bake provided by the Water Works Manufacturers' Association, and an exhibit of appliances by the latter, combined to make the forty-first annual convention of the New England Water Works Association at New Bedford, Mass., last week a success. The Dexter Brackett Memorial Medal for the best paper published in the association's *Journal* last year was awarded to X. H. Goodnough, chief engineer, Massachusetts Department of Health, for his paper on "Rainfall in New England." This paper, stated Robert Spurr Weston, chairman of the committee on award, was the summing up of twenty years of studies by Mr. Goodnough.

The chief business transacted at the convention, aside from the report just mentioned, was the adoption of resolutions providing for the appointment of two committees of Massachusetts members to take up with the state authorities of Massachusetts (1) the subject of merging water departments with other municipal departments and (2) the financing of water-works. The Committee on Standard Meter Specifications made a "progress report."

Abstracts of the papers and discussions appear elsewhere in this issue.

Brings Suit Over Twin Lakes Dam

Suit has been filed in the United States District Court of Boise, Idaho, by the Western Construction Co., to obtain $126,440 alleged to be due and owing for construction work on the north and south dams at Twin Lakes reservoir.

Reject Plan for Free Ports

In the issue of Sept. 14, p. 453, *Engineering News-Record* announced that a provision for free ports had been taken by the joint House and Senate conference from the bonus bill. This was in error. The free ports plan was taken from the tariff bill by the conference committee having it in charge.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS, St. Petersburg, Fla.; Annual Convention, Cleveland, Ohio, Oct. 2-6.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York; Fall Meeting, San Francisco, Oct. 4-9.

AMERICAN PUBLIC HEALTH ASSOCIATION, New York; Annual Convention, Cleveland, Oct. 16-19.

The Rochester Engineering Society opened its fall season with a smoker Sept. 8. Besides "smokes" and refreshments, an entertainment was provided consisting of vaudeville sketches, moving pictures, and boxing bouts.

PERSONAL NOTES

JOHN H. DUNLAP, secretary of the American Society of Civil Engineers, left New York Sept. 18 to attend the fall meeting of the society in San Francisco, Oct. 4 to 8. En route he will address a number of the organization's local sections as follows: Detroit and Ann Arbor, Mich., Sept. 19; Chicago, Sept. 20; St. Louis, Sept. 21; Kansas City, Sept. 22; Kansas City, Sept. 23; Omaha, Sept. 25; Denver, Sept. 26; Salt Lake City, Sept. 28; Portland, Ore., Oct. 11; Seattle, Oct. 12; Spokane, Oct. 13; Duluth, Oct. 16; and St. Paul, Oct. 17.

D. E. HENRY, senior highway engineer, U. S. Bureau of Public Roads, for the past two years in the offices of District 6 at Ft. Worth, Texas, has resigned to become office engineer of Division 4, California Highway Department, with headquarters at San Francisco.

DR. ELWOOD MEAD, professor of rural institutions, University of California, and founder of the Durham and Delhi irrigations colonies in California, has been made an honorary member of the American Society of Agricultural Engineers.

COL. FRANK B. PARKER is an applicant for the office of postmaster at Ft. Worth, Texas.. Col. Parker, who has been a prominent citizen of Ft. Worth for over 15 years, was an engineer officer during the war, being commander of the American railway engineer troops at Vladivostick, Russia. He is now Texas representative for the Oil Insurance Association.

W. C. MARKHAM of Baldwin, Kansas, formerly Secretary of the Kansas Highway Commission at Topeka, and legislative representative of the American Association of State Highway Officials, has been appointed to a position with the U. S. Bureau of Public Roads, at Washington, D. C. His work will be largely that of handling relations of the federal board with the various State Highway Commissions. Mr. Markham represented the state highway commissions during the recent session of Congress, prior to the passage of the Federal Highway Act.

PAUL P. GOODELL, director of public works of Stratford, Conn., has resigned his position effective Oct. 1, to enter private business. A successor has not yet been appointed by Rutherford H. Hunter, town manager.

EDWIN F. GREENE, of the firm of Lockwood, Greene & Co., Inc., engineers, Boston, recently returned to Boston after an extended European trip.

FRED PETZOLD, formerly connected with the Thompson-Starrett Co., building contractors of New York City, as field engineer, has joined the H. G. Christman Co., South Bend, Ind., contractors and engineers. His new position is that of construction engineer.

MAXWELL, LEFTWICH & SMITH, an engineering firm, has been organized in Tuscaloosa, Ala., for service in industrial appraisals, power-plant tests, surveys, material tests and reports, and design and construction of power plants.

MARTIN W. COWLES, senior assistant engineer, Illinois Department of Public Health, has recently become associated with Clarence W. Marsh, 101 Park Avenue, New York City, in developing the electrolytic production of chlorine at the point of consumption for use in waterworks, swimming pools and for other sanitary and industrial requirements.

J. S. RUBLE has been elected vice-president in charge of all construction of the H. K. Ferguson Co., engineers and builders, Cleveland, Ohio. Mr. Ruble resigned recently as vice-president of the Austin Co., which position he had held for the past nine years. After graduation in mechanical engineering from Pennsylvania State College in 1901 he was engaged for four years in dock, ore storage, and unloading equipment, design and construction with Hoover & Mason, contracting engineers. He served for eight years as an engineer with the U. S. Steel Corp. at Pittsburgh, Cleveland, and Birmingham. At the latter point he was construction engineer for the Tennessee Coal, Iron & Railroad Co., where he was engaged in the design and construction of heavy foundations for blast furnaces, steel mills and power plants. To Mr. Ruble's other experience with corporations there is added the developing and placing in operation of completely equipped coal mines, involving shaft sinking, tunneling and installation of equipment including the power plant and repair shops, together with camps, commissaries, streets and sanitary systems.

H. NECKER, chief engineer of the Department of Roads, Quebec, Can., has been awarded the Order of the British Empire by King George in recognition of services rendered the British Mission of the League of Nations as consulting engineer.

OBITUARY

GEORGE F. BEATTY, building contractor, Brooklyn, New York, died Sept. 9 after an illness of seven months.

ALLYN G. BRIDGE, treasurer of the Amos D. Bridge's Sons, Inc., road building contractors of Hazardville, Conn., died at his home in that town, Sept. 7. Mr. Bridge was born in Hazardville July 10, 1865. Most of his road and paving work was done in the New England states and New York.

FREDERICK R. MILLER, of the firm of Roger Miller & Sons, Toronto, Can., engineers and contractors, died Aug. 30, aged 44 years. Mr. Miller was prominent in public life, having rendered important services to the government during the war. In 1916 he had charge of the production of munitions in the Toronto district and was afterwards appointed by the Imperial Munitions Board as vice-president and general manager of British Forgings, Ltd. Recently he was appointed a member of the Ontario Hydro-Electric Commission and the Toronto Transportation Commission. During his professional career he had charge of many important engineering works, including several contracts in connection with the improvement of the Toronto harbor.

From the Manufacturer's Point of View

Wanted: Better Salesmanship for American Firms Abroad

BY JULIUS KLEIN
Director, Bureau of Foreign and Domestic Commerce, Washington, D. C.

One of the essentials to our success in foreign business today is the selection of efficient traveling representatives of American firms for service abroad.

Several instances have recently been brought to light where unwise appointments have proved extremely costly. In foreign countries the traveling representative of an American house is regarded as the spokesman of his country as well as of his company; he has the power to build up or damage the prestige of both. Every effort should be made, therefore, to secure capable Americans to perform the task, even at some temporary sacrifice in domestic trade.

A partially successful pill salesman, whose sole qualification for the position is knowledge of Spanish and of "the customs of the people," made an American automobile company ridiculous in the eyes of scores of shrewd Latin-American business executives who put the incident down as "just one more example of Yankee stupidity."

Precisely the same mistake was made by a leading revolver concern which sent out as its South American salesman an accomplished linguist, the son of a missionary, born and brought up abroad, who had spent two weeks in the factory in New England. On his first business call he took his samples apart and couldn't put them together again.

It is nothing less than absurd for a steel company to send to Europe a man who does not possess a fundamental knowledge of the steel business—whose only asset, probably, is a long tour in Europe in a non-commercial capacity or as a pleasure seeker. In this country a salesman or field office manager can get in touch with the home office by telephone if in trouble. Abroad, this is usually impossible unless he has long distance radio receiving and sending sets in his pocket.

NATIONALITY

On the subject of nationality, many firms favor the selection of a real American, bearing the indubitable appearance of one in preference to a naturalized citizen who is selected solely because of his knowledge of the language and customs of his native land. Many foreign firms have a keen respect for American business methods and they will frequently do business with a bona fide "Yankee" who evidently lacks polish, as against a man of their own nationality who approaches them as the representative of an American house. His record, his character, his family connections in the country and many other factors may mitigate against his success in his home country in the robes of a "Yankee salesman."

In considering a prospective traveling agent, it is undesirable to give exclusive attention to any single element or phase of his equipment. He must be suited (a) to the territory

and the trade to be visited; (b) to the line of goods to be handled; and (c) to the commercial policies of his employer. He must be a trade builder in the wider sense and not a mere order-book filler. The agent should be a man of good education, thoroughly versed in the fundamental technical aspects of his field. He should possess a broad fund of information so that he can converse with foreign buyers about something besides his own line of goods. Superficial knowledge of the topics of the day frequently paves the way for profitable business, especially in Latin-America. He should be able to sell American manufacturing methods as effectively as a bill of merchandise or an individual unit of machinery.

Personality and stability of moral character are factors whose importance can scarcely be overestimated. The habitual gambler, the drunkard, or the fast liver is a distinct liability, no matter how brilliant he may be as a salesman. It should be made clear, however, that this warning does not imply any prejudice against the salesman who is a good mixer, who blends his social activities with restraint and proper standards of living.

Tact and good manners are also essentials. The hustler with his American line of bluff, good-fellowship frequently meets with disaster in South America. The Latin-American is accustomed to well-phrased compliments and a strict observance of certain conventions. He dislikes the appearance of doing business in a hurry, yet understanding of proper approach often results in actual orders almost as quickly as in the United States.

The "plugger" type is preferred to the temperamental "star" salesman, for it has been found that the latter often suffers severe failure abroad when his customary spectacular methods cannot be adjusted to foreign conditions.

AGENCIES

The salesman pioneering for his house and expected to select permanent agents must possess sound judgment. It is a common fault in this regard to assign agencies to dealers placing the largest orders, irrespective of the dealers' organization, stability, and capacity to render service. Equally dangerous is the selection of a house which is already handling so many more profitable classes of goods that the new line is certain to be slighted or ignored. When the agent selected happens to be a European, handling competing European goods, the error is all the more serious. The ability, therefore, to form a shrewd, just estimate of persons and situations is invaluable.

Sales instinct, the desirability of preliminary training in the home office, preliminary knowledge of foreign conditions, ability to speak the language of the country, accuracy and exactness, supervision over traveling representatives, the salary question, continuity in service, and legal aspects, are some of the other factors involving the solution of "The Salesman Problem."

Lumber Standardization Progressing

Following conferences initiated by the U. S. Department of Commerce and held at Washington, Chicago and Portland, Ore., it is announced that there is every prospect that a standardization of lumber trade practices will come about in a fairly short time. There is now working a central committee on lumber standards, comprising representatives of the lumber manufacturers, the retail lumber dealers, the lumber wholesalers, the architects and the engineers.

This committee will develop a program of lumber standardization along the following lines: First, lumber grades and grade names, second lumber sizes, third, guarantees for the protection of the public. It is working in co-operation with the Department of Commerce in the same manner as the paving brick manufacturers worked in producing their recent standards of sizes. The committee is made up of John W. Blodgett, of the Blodgett Co., Grand Rapids, Mich., chairman; John H. Kirby and Charles A. Goodman, representing manufacturers; Dwight Hinckley, representing the wholesalers; John E. Lloyd, representing retailers; W. E. Hawley, of the Duluth, Missabe & Northern Ry., representing railways and engineers, and E. S. Hall, representing the architects.

BUSINESS NOTES

The HOTCHKISS STEEL PRODUCTS CO., Binghamton, N. Y., has put into effect this month a new sales policy for its steel road forms which are now being sold through the Hotchkiss agent organization. Previously these forms had been distributed through an outside selling organization. Under the new arrangement all matters pertaining to the sale of the road forms will be directed by R. C. Weller, sales manager, 1411 Lumber Exchange Building, Chicago.

C. E. REESE, editor of the *Gas Engineering and Appliance Catalogue* and associate editor of the *Gas Age-Record*, has joined the stoker sales department of the Westinghouse Electric & Manufacturing Co., at South Philadelphia. He was previously cadet engineer and combustion engineer with Henry L. Doherty & Co., and assistant engineer of the Illinois Public Utilities Commission.

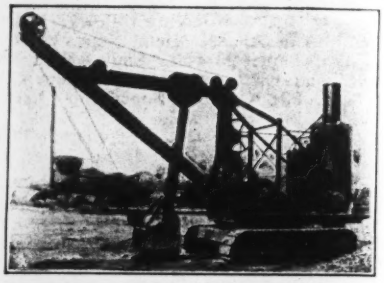
EQUIPMENT AND MATERIALS

Power Shovel with Horizontal Boom and Trolley

A new power shovel with ¾-yd. dipper designed for steam, electric or gasoline-engine operation is announced by the Fairbanks Steam Shovel Co., Marion, Ohio. The feature of the equipment is the horizontal digging boom and dipper handle shown in the accompanying illustration. The manufacturers point out that a much longer reach and dumping range can be obtained with this boom than with other types and that the highest trucks and wagons can be easily loaded. The shovel is particularly adapted to road and street construction and stripping.

Other features of the new shovel, designated as Model K, are its crawler traction, full revolving swing, submerged tube ASME boiler and Fairbanks reversing valve engines. If desired a standard boom and dipper handle can be substituted for the horizontal boom illustrated.

The dipper handle is hinged to the trolley and is operated back and forth



by cables fastened to a small drum on the trolley and a friction drum on the A-frame. An automatic stop device at each end of the travel insures against broken cables. The trolley may be held stationary at any point and the dipper handle may be adjusted for deep digging.

Many Special Features in Latest Type of Loader

A number of special features have been incorporated in the latest type of portable bucket loader, known as the Tanktred, manufactured by the Jeffrey Manufacturing Co., Columbus, Ohio. For the mounting a three-point suspension and crawler treads are employed. The buckets are of malleable iron with

steel cutting edges. The foot of the elevator is so constructed that the buckets are wider than any other part, allowing the machine to be advanced several feet into the pile with nothing but the cutting edge of the bucket in contact with the material.

A relatively large foot-wheel reduces centrifugal force and enables the bucket to pick up material, especially large lumps, without kicking them away. Flexibility of operation is secured by two speeds, a traveling speed for moving the machine from place to place and a feeding speed for driving the machine into the pile. Only one man is required to operate the loader.

A loading clearance of 9 ft. 6 in. allows the loader to serve the largest automobile trucks, a universal swivel

spout facilitating the spotting of the material to be loaded, without necessitating movement of the truck. Storage hoppers receive the discharge from the buckets, thus enabling the elevator to work while a full truck is being pulled away and an empty one spotted under the discharge spout.

Light-Weight Trench Excavator

A compact, light-weight trench excavating machine, with weight evenly distributed on crawler treads, has been developed by the A. J. Penote Co., of Cleveland for use in streets or on lawns for the installation of underground conduits, gas or water mains.

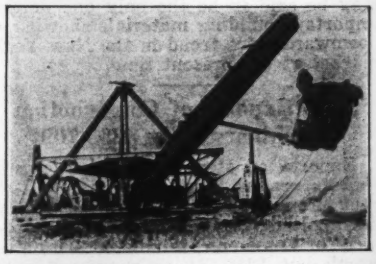
The equipment weighs 5 tons and is provided with a cutting ring 6 ft. in diameter, carrying a series of buckets as shown in the illustration. Power is furnished by a 20-hp. gasoline engine. The overall length is 16 ft. and the width 4½ ft.

The machine will excavate a trench 5 ft. deep with a minimum width of 10 in. and a maximum width of 20 in. The crawlers are equipped with rubber pads to protect lawns and sidewalks.

While the machine was built primarily for the Penote company's own use on a job in Detroit, so many inquiries have been received regarding it that plans are being made to manufacture and sell it.

A 1½-Yd. Dredge for Drainage Contractors' Use

A 1½-yd. dredge, designed particularly for handling material on drainage contracts has been placed upon the market by the Bay City Dredge Works,



Bay City, Mich. Among the mechanical improvements incorporated in this dredge are a plate steel boom, type Z dipper, all-steel castings, band type clutches, heavy geared crowding device, and double cable on the boom guy. The machine is similar in design to the Bay City company's 1-yd. dredge, differing in its larger capacity and heavier construction throughout. It is claimed that the same operating crew can run the 1½-yd. dredge as is required for the 1-yd. dredge. The total shipping weight of the dredge is 100,000 lb.

The manufacturers state that M. J. Zabawa, working in Martin County, Minn., is handling 12,000 yd. per day in a single shift with one of the 1½-yd. dredges equipped with type Z dipper.

Combination Crane and Shovel

Designed for use by contractors and in supply yards, railroad or industrial plants, a new combination crane and shovel with crawler treads has been developed by the Orton & Steinbrenner Co., of Chicago, Ill. Two sizes of machine, ¾-yd. and 1-yd., are being manufactured. The design enables the crane boom to be removed and the shovel boom and dipper substituted. For work of tearing up pavements a separate boom with skimmer scoop can be connected to the crane independent of the main crane boom, in which case the hoist line is simply reeved over the scoop.

Motive power is supplied by only two engines, thus simplifying operation.

The hoisting, swinging, and traveling movements are performed with double clutches by the main non-reversing engines, while the crowding motion of the dipper is actuated by a separate reversing engine placed midway along the boom. The rotating base turns on a ring of rollers. The frame of the machine is of structural steel shapes and plates, riveted and reinforced.

The tread links are so designed that in passing around the socket all foreign material adhering to them is thrown off and prevented from entering the spaces between. A feature of the machine, its manufacturers claim, is the accessibility of its parts, especially those bearing the brunt of wear, so that field repairs, when needed, can be made with the minimum amount of lost time.

Out-of-the-Ordinary Trade Publications

Drag Scraper—THE LINK BELT CO., Chicago, features its "power hoe" or improved drag scraper in a 24-page illustrated booklet just issued. Among the applications of the power hoe are for storing coal and handling sand, gravel and crushed stone. Sketches indicate layouts for loading material from storage piles to box cars, for enlarging trestle storage, for delivery of coal from storage pile to power house, for loading from ground storage piles into trucks with the aid of an elevating conveyor, and for transferring bulk material from bottom-dump railroad cars to storage piles.

Road Oilers, Sweepers and Sprinklers—THE AUSTIN MANUFACTURING CO., Chicago, has just gotten out a 40-p. illustrated catalog describing its wide variety of equipment for the oiling, sweeping and sprinkling of roads. The foreword presents a picture of the development of road oiling since the first experiments in this country were undertaken in California in 1901. The Austin company built its first successful pressure road oiler about ten years ago and shortly afterward introduced its heater attachment; up to that time gravity type distributers were almost exclusively used. Pressure oilers are shown in the catalog with or without the heater attachment. The capacity of the horse-drawn type is 600 gal. and of motor-driven types from 600 to 1,000 gal. Detailed specifications are given for each type, as well as for a 750-gal. trailer oiler. In connection with its water sprinklers, details are given of the Austin vertical perforated spray head. Street sweepers with single and double-speed broom drives are illustrated and described.

Roof Leader and Vent Connections—THE BARRETT CO., New York, in a 28-page illustrated booklet explains the design features and uses of Holt roof connections with flat roof or saw-tooth construction. These connections may be employed at any place where vent pipes, leader lines, steam stacks, flag poles, or other fixtures passing through the roof require flashings. The booklet illustrates and describes eight types of Holt connections. A table shows the relationship between area of roof to be drained and size of leader pipe. There are included Barrett roof specifications.

Wall Colors and Illumination—THE EDISON LAMP WORKS of the General Electric Co., Harrison, N. J., has published a 16-p. illustrated booklet by A. L. Powell, discussing the effect of color of walls and ceilings on resultant illumination. It is pointed out that if the surroundings are not adapted to reflecting such light as strikes them, the lighting system, no matter how carefully designed, will be inefficient. The booklet takes up in detail the question of proper painting and papering of walls and ceilings. A table is given showing the percentages of light reflected on surfaces of various colors.

Business Side of Construction

Facts and Events that Affect Cost and Volume

Salt Water in Oil Wells Affects Asphalt Prices

Mexican Crude Oil Production Falling Off Owing To Appearance of Brine—Road Oils and Asphalt Higher

Recent rises in the price of asphalt and road oils, as noted in *Engineering News-Record*, are explained by salt water encroachments in the light-oil fields of Mexico. According to the *Oil Trade Journal* reports from the South Fields of Mexico indicate that twenty of the thirty-one producing wells in the Toteco-Cerro Azul pool are showing salt water in amounts ranging from less than 1 per cent to as high as 15 per cent, with a recently completed well in the adjoining district of Chiconcilla showing 25 per cent.

The "stripping" process which has been put into use in these wells has been successful in keeping up a daily production of from 140,000 to 150,000 bbl. since the water appeared and three companies, agreeing upon joint regulation of production from this field, will each take out oil as desired, making the life of the pool a matter of speculation.

Imports of Mexican crude oil on July 15 had fallen off to a rate of fully 5,000,000 bbl. less per month than in the pervious months. Signs are numerous that the reduction in output will be even greater in the future, as there are at present not other pools of equal productive possibilities under development, or even in prospect, in Mexico. Six other wells also showed salt water in varying quantities.

The effect of the Mexican oil situation upon the construction materials market, has been to create a rising tendency in asphalt prices. In the New York market asphalt in bulk is now quoted at $14 as against $13, and $20 in packages as compared with $17.50 per ton, one month ago. Baltimore also quotes Mexican asphalt at $14 and Atlanta, $17.50 in bulk; both representing advances of $1 per ton over August. Detroit recently quoted a rise of $4.50 in bulk and $3.50 in packages; Philadelphia also announced an advance.

Anthracite Coal Output Increasing

The country's normal supply of anthracite coal fell short approximately 30,000,000 tons, as a result of the five months' suspension, according to the Coal Bureau of the Chamber of Commerce of the United States.

The report continues: "the normal yearly production of anthracite coal suitable for household purposes is about 72,000,000 tons. As it is possible to store anthracite safely for long periods, the industry is organized to run with fair uniformity throughout the year. It is the custom of producers, dealers and many domestic consumers to accumulate supplies in the summer and fall against winter needs. As the productive capacity of the anthracite mines

(Concluded on p. 500)

Finance Briefs

Stock market still rising. Steady buying of investment stocks due to easier money market last week. General public is buying for a continuation of the rise.

Bond market steady for all classes. Heavy demand for municipals, with many new issues. Railroad, industrial, public utility and Liberty bonds in active demand. Trading dull in foreign securities.

Foreign Exchange market lower on French, Belgian, Italian and other Continental rates, due to uncertain political situation. Abrupt drop in sterling to $4.41, lowest since July 3, to establish dollar credits for coming grain and cotton bills. Italian rate touches new low for the year, 4.18½.

Money market showing firmer tone in call rates, 4 per cent in early part of this week, due partly to Government withdrawal of $46,000,000.

Brick Prices Advance But Slightly Compared with Other Materials

Brick prices were already so high, in many instances, with demand decreasing, that even fuel shortage and poor transportation facilities have done little to boost prices still higher. According to the Common Brick Manufacturers' Association of America orders on the books of its members exceed by 66,000,000 the amount of burned and unburned brick on hand.

Advances in price occurred in five out of twenty-two cities reporting to *Engineering News-Record* during September; with declines in but two. Minneapolis quotes $18@$19, delivered, as against $17@$18 per M, last month; Kansas City, $16.50 as against $14.50; New Orleans, $13, up from $12.50; Atlanta $12, from $11 and Cleveland, $16 as compared with $14, one month ago. Dallas, however, quotes $10.90; down from $11.15 and New York, $15@$17, wholesale, alongside dock, or $18@$20.20 delivered; with $20 the prevailing price one month ago and $18 per M, wholesale, last week.

The situation in New York may be attributed to an actual increase in the supply as well as a shortage of second-hand brick. Scarcity of the used product helps keep up the demand for the present output of new brick, while increased production serves to deflate the price and also to dispel the recent fears of shortage. Brick, therefore, may be said to be the only one of the important building materials showing a downward price trend in the New York market at the present time.

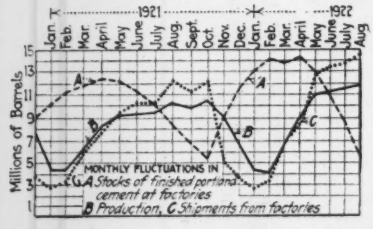
REPORT ON COMMON BRICK FROM 95 YARDS AS OF AUGUST 1, 1922

Dist. No.	Including States of	No. of firms reporting	Plants closed down	Burned brick on hand	Unburned brick on hand	Orders on books	Price per thousand at brickyard
1.	N. Y., New England	6	1	1,616,000	2,759,000	4,590,000	$14.00 to $19.00
2.	Pa., N. J., Md., D. C., Del.	9	0	10,043,000	6,834,000	35,034,000	12.50 to 17.00
3.	Va., N. C., S. C., Ga., Fla.	5	2	3,826,000	2,694,000	5,105,000	10.00 to 18.50
4.	Mich., Ohio, W. Va.	11	1	4,974,000	5,221,000	20,008,000	12.00 to 17.00
5.	Ill., Ind., Wis.	23	1	130,302,000	1,710,000	188,947,000	11.00 to 15.50
6.	Ky., Tenn., Miss., Ala., Ark., La.	13	1	18,753,000	5,743,000	13,453,000	9.10 to 16.00
7.	N. & S. Dak., Minn., Neb., Ia., Kan., Mo.	11	4	3,099,000	4,885,000	3,610,000	10.00 to 18.00
8.	Okla., Tex., N. M.	7	3	3,169,000	2,058,000	1,629,000	8.00 to 12.00
9.	Wash., Ore., Mont., Wyo., Ida., Utah, Colo.	7	0	4,507,000	624,000	4,503,000	12.00 to 19.25
10.	Calif., Ariz., Nev.	2	0	3,935,000	4,267,000	10,265,000	14.00 to 14.70
		94	10	184,224,000	36,795,000	287,144,000	

August Cement Output and Shipments Heavier Than July

Production of portland cement in the United States during August, according to the Geological Survey, totaled 11,064,000 bbl., an increase of 107,000 bbl. over the preceding month. Shipments amounted to 14,361,000 bbl. or 511,000 bbl. heavier than July.

Despite the fuel and car shortage both production and shipments during



August show improvement over July records. In fact, the August output exceeds that of the corresponding period in 1921, by 1,420,000 bbl. Shipments in August, 1922, showed an increase of 2,021,000 bbl. over the same month last year. A rate of shipment in excess of production, left only 5,737,000 bbl. in reserve at the end of August, which was 2,696,000 bbl. under the stocks on hand, July 31.

June Exports of Construction Machinery Only $263,709

Exports of steam and other power shovels, cranes, hoists and derricks (except mining) from the United States during June, as reported by the Department of Commerce, numbered 329 units, worth but $219,131 as compared with 226 units, valued at $376,832 during May. Dredging machinery, weighing 256,869 lb. and worth $44,578, most of which went to France, Canada, Central and South America, would bring the total for this class of exports to $263,709.

Of the thirty-seven steam shovels, France took thirty-one; England, one; Japan, two and Canada, three.

Bond Sales for Last Eight Months Heaviest Since 1892

The amount of long-term municipal bonds sold during August was of relatively moderate proportions, for these times, totaling only $65,911,016 as against $92,958,989 for July and $94,638,755 during August, 1921, according to records kept by the *Commercial Financial Chronicle.*

Despite the abrupt drop in bond issues in August, a remarkably steady increase in new offerings has been in evidence during the last two weeks.

Bond sales from Jan. 1 to Sept. 1 totaled $810,183,774 as against $665,858,366 for the first eight months of 1921 and $448,830,120 for the corresponding period in 1919, the highest three periods during the last thirty years.

Among the more important issues were: North Carolina, $5,000,000 4s and $2,300,000 4½s and State of Oregon, $1,500,000 4½s at 102.31, a basis of about 4.29 per cent; Hudson County, N. J., $1,554,000 4½s, on a basis of 4.35@4.45 per cent; City of Minneapolis, Minn., $1,120,000 4½s at 102.271, a basis of about 4.30 per cent and Bay City, Mich., $1,000,000 5½s at 105.033, a basis of about 5.08 per cent.

Short-term securities issued during August totaled $23,321,000, including New York City temporary loan negotiations amounting to $11,600,000.

Of the fifty-six representative issues shown in the accompanying table, seven sold at par, forty-eight above and only one below par; the yields ranging from 4.20 to 5.97, with one at 6.25 per cent. The rates varied from 4 to 6 per cent, with one issue in Idaho at 7. All those drawing 6 per cent were in the Southern and Western states; the single 4½ being in Maine and the one 4 per cent issue in Vermont.

Next week — Why 1913 is used as a base by the United States Bureau of Labor Statistics.

Bids Wanted on Big Jobs

Among the projects on which bids are either asked or will soon be called for in Construction News, pp. 147 to 159, are the following projects:

Sewers in various streets, Chicago, Ill., $2,000,000. C. D. Hill, ch. engr.

Five-story building including garage, Montreal, Que., $1,000,000.

Office and stores, 12 story, Philadelphia, Pa., $1,000,000.

REPRESENTATIVE PUBLIC BOND SALES DURING SEPTEMBER, 1922

State	Purpose	Amount	Maturity	Rate Per Cent	Basis	Sold For	Dated	Purchased By
Missouri	Road	$5,000,000	1926-27	4½	4.35	100.6443	Sept. 1, 1922	Liberty Central Trust Co. of St. Louis
County								
Bartholomew, Ind.	Highway	15,600	1923-32	4½	....	100	Aug. 28, 1922	Union Trust Co. of Columbus.
Beaver, Pa.	Courthouse	100,000	1923-32	4½	4.20	103.37	Sept. 1, 1922	Union Trust Co. of Pittsburgh.
	Road	150,000	1933-47	....	....	.....	.....	.....
	Hospital	50,000	1948-52	....	....	.....	.....	.....
Clearfield, Pa.	Road	325,000	1952	4½	....	102.52	Sept. 1, 1922	Harrison, Smith & Co., Philadelphia.
Dearborn, Ind.	Highway	19,000	1923-37	5	4.73	101.88	Sept. 1, 1922	Peoples Nat. Bank of Lawrenceburg.
Floyd, Ind.	Highway	10,200	1923-37	5	4.73	101.889	Sept. 1, 1922	Dearborn Nat. Bank of Lawrenceburg.
		27,400	1942	4½	....	100.53	May 15, 1922	Fletcher Savings & Trust Co. of Indianapolis.
Franklin, Ohio	Highway	59,000	1925-32	5	4.73	101.39	Aug. 1, 1922	Seasongood and Mayer, Cincinnati.
Guilford, N. C.	Hospital	100,000	1923-57	4½	4.73	100.13	Sept. 1, 1922	Taylor, Ewart & Co., Chicago.
Kalamazoo, Mich.	Roads	38,600	.....	5½	....	100.04	.....	Detroit Trust Co., Detroit.
Madison Co. Road Dist. No. 3, Miss.	Highway improvement	96,000	1923-47	5½	....	101.29	Sept. 5, 1922	Kauffman, Smith, Emert Co., Inc., of St. Louis.
Monroe, Mich.	Road	77,000	.....	5½	....	100.818	.....	Prudden & Co., Toledo.
Monroe Co. Road Imp't. Dist. No. 3, Ark.	Road improvement	160,000	1942	6	....	102.50	Sept. 4, 1922	The First National Co. of St. Louis
Ocean, N. J.	Road improvement	150,000	1926	5½	....	100.30	June 1, 1922	Security Trust Co., Camden.
Randolph, Ind.	Highway	23,000	1923-32	5	4.74	101.25	Aug. 15, 1922	Gavin L. Payne Co., Indianapolis.
Red River, Atchafalaya & Bayou Levee Dist., La.	Levee	400,000	.....	....	....	100.56	.....	L. E. French & Co., Alexandria and others
Redwood, Minn.	Ditch	165,000	1928-42	4½	4.49	100.19	Sept. 1, 1922	Capitol Trust & Savings Bank of St. Paul
	Highway	12,484	1932					
Tensas Basin Levee Dist., La.	Levee	120,000	1932-61	5	....	100.91	Sept. 1, 1922	Marine Bank and Trust Co. of New Orleans
Tilamook, Ore.	Road	71,400	1937-39	5½	4.93	106.27	July 1, 1922	Lumbermens' Trust Co. of Portland.
Tipton, Ind.	Highway	2,000	1923-32	5	....	100	Aug. 25, 1922	Citizens Nat. Bank of Tipton.
Vanderburgh, Ind.	Roads	28,680	1923-32	4½	....	100	Sept. 2, 1922	Fridy & Maurer, Evansville.
Wells, Ind.	Highway	2,000	1923-32	4½	....	100	Aug. 15, 1922	Wells County Bank of Bluffton.
Township								
Harrison, Allegheny Co., Pa.	Sewer	50,000	1925-49	4½	4.37	101.4105	Sept. 1, 1922	Mellon Nat. Bank of Pittsburgh.
Hayden Lake, Irr. Dist. Kootenai Co., Idaho	Irrigation	100,000	1933-42	7	6.25	.....	July 1, 1922	Ralph Schneeloch Co., Portland.
Linden, Union Co., N. J.	Street improvement	181,000	1923-42	4½	4.32	101.534	Sept. 1, 1922	Nat. State Bank of Elizabeth.
Municipality								
Asheboro, N. C.	Street improvement	$135,000	1925-39	5½	5.23	100.13	July 1, 1922	Taylor, Ewart & Co., Chicago.
Ashville, Pa.	Street improvement	11,000	1924-45	5	4.90	100.875	July 1, 1922	E. H. Rollins & Sons.
Belhaven, N. C.	Electric light system	30,000	1925-52	6	5.97	100.37	July 1, 1922	W. K. Terry & Co., Toledo.
Biddeford, Me.	Sewer	50,000	1927-36	4½	4.24	100.069	July 5, 1922	Merrill, Oldham & Co., Boston.
	Street	25,000	1927-31	....	....	.....	.....	.....
Boulder, Col.	Reservoir	100,000	1937	4½	....	100.061	Oct. 1, 1922	James H. Causey & Co., Denver. Benwell, Phillips & Co., Denver.
Cape May, N. J.	Paving	66,500	1923-42	5	....	100	Sept. 25, 1922	Merchants' National Bank of Cape May
Carlton, Minn.	Waterworks	15,000	.....	5½	....	102.66	Sept. 1, 1922	Capitol Trust and Savings Bank of St. Paul
Cedar Rapids, Ia.	Waterworks	100,000	1923-42	4½	4.30	103.60	June 15, 1922	Weil, Roth & Co., Cincinnati.
Chatham, Va.	Street repair	12,000	1952	6	....	100.41	Sept. 1, 1922	Chatham Savings Bank.
Dubuque, Ia.	Grading	75,000	Serially	5	....	102.20	July 1, 1922	Bonbright & Co., Chicago.
East Spencer, N. C.	Street improvement	15,000	1925-39	6	5.90	100.60	July 1, 1922	George & Fetner, Cherryville.
Fairview, N. J.	Disposal plant	33,000	1923-55	5½	5.47	100.378	Aug. 1, 1922	B. J. Van Ingen & Co., New York.
Genoa, Ohio	Street improvement	15,000	1923-31	5½	....	100.61	Aug. 1, 1922	Ryan, Bowman & Co., Toledo.
Greenburgh, N. Y.	Highway	31,800	1923-33	5	4.34	103.43	Sept. 1, 1922	Scarsdale Nat. Bank.
Greenfield, Ohio	Street improvement	8,000	1923-30	5½	5.11	101.55	Aug. 1, 1922	Davies-Bertram Co., Cincinnati.
Kent, Ohio	Waterworks	200,000	1923-47	5	4.71	102.57	Sept. 1, 1922	A. T. Bell & Co., Toledo.
Kinston, N. C.	Waterworks	50,000	1925-62	5	4.99	100.11	Aug. 1, 1922	Caldwell & Co., Nashville.
	Street improvement	50,000	1925-42	5	4.99	100.11	.....	.....
Madison, N. J.	Gen'l improvement	69,000	1923-48	4½	4.34	101.74	Sept. 1, 1922	J. G. White & Co., New York.
Montclair, N. J.	Permanent improvement	50,120	1923-42	4½	4.37	101.135	Oct. 2, 1922	J. S. Rippel & Co., Newark.
Mt. Morris, N. Y.	Pavement	72,000	1923-48	4½	4.48	100.157	Sept. 1, 1922	Farson, Son & Co., New York.
Muskegon, Mich.	Improvement	105,000	1923-32	4½	....	100	Sept. 1, 1922	Kean, Higbie & Co., Detroit.
Norwood, N. Y.	Streets	3,000	1924-29	5	4.75	101	July 1, 1922	State Bank of Norwood.
Oakwood, Ohio	Sewer	32,000	1923-32	6	5.27	103.26	July 15, 1922	Seasongood & Mayer, Cincinnati.
Ogema, Minn.	Electric lights	13,000	1930-42	6	5.85	101.50	Aug. 1, 1922	Drake-Ballard Co., Minneapolis.
Plant City, Fla.	City improvement	150,000	.....	6	....	104.04	Aug. 1, 1922	Hillsboro State Bank of Plant City and Caldwell & Co., of Nashville.
St. Albans, Vt.	Street improvement	20,000	1933-36	4	4.19	98.17	Aug. 1, 1922	Harris, Forbes & Co., Boston.
St. Joseph, Mo.	Sewer	795,000	1927-41	5	4.52	104.132	May 1, 1922	Harris Trust & Savings Bank of Chicago.
Sacramento, Cal.	River filtration	900,000	1923-61	5½	4.57	111.932	Jan. 1, 1922	Anglo-London-Paris Co. of San Francisco; Eldredge & Co. and Kissel, Kinnicutt & Co. of New York.
Thomasville, N. C.	Street	75,000	1925-39	5½	....	101.04	Aug. 1, 1922	Bolger, Mosser & Willaman of Chicago.
Topeka, Kan.	Genl. improvement	100,000	.....	4½	....	101.75	Aug. 29, 1922	Brown-Crummer Co., Wichita.
Watertown, Mass.	Sewer	9,000	1923-31	4½	4.31	100.826	Sept. 1, 1922	Arthur Perry & Co., Boston.
Windber, Pa.	Improvement	15,000	1946	4½	....	100	Nov. 1, 1916	Windber Trust Co.

Anthracite Coal Output

(Concluded from p. 498)

is sufficient to take care of this uniform demand only, it is apparent that any interruption in the regular production during the summer is bound to create a shortage which cannot be overcome.

"There are no accurate figures as to stocks of anthracite usually carried by producers, by dealers, or in the bins of household consumers. It is known, however, that broadly speaking, stocks of anthracite were exhausted. The strike has already caused a five months' interruption in normal production—a shortage amounting to 30,000,000 tons.

Except for a few thousand tons recovered by dredging the rivers, there was absolutely no production of anthracite coal from April 1 to Sept. 11, at which date the mines reopened with a production rate of approximately 17,500 tons for the first day, in three Pennsylvania districts.

On the first day of resumed mining activities the Lehigh Valley R.R. hauled thirty carloads of freshly mined anthracite coal, in domestic sizes, to the New York market alone. The second day, Sept. 12, witnessed the shipment of eighty-five carloads from the Shamokin, Pa., district as the result of a single day's production.

With rapid increases in output and facilitated deliveries of domestic hard coal, owing to rigid freight embargoes on all materials other than necessities, the anthracite shortage, while not completely overcome, will be greatly alleviated. The effects of a car shortage will be felt, however, principally by shippers of construction materials.

Weekly Construction Market

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.

Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section.

The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of September 7; the next, on October 5.

Steel Products:	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Structural shapes, 100 lb	$3.04	$3.65	$4.20	$2.92½	$3.05	$3.80	$3.25	+$3.90	$3.75
Structural rivets, 100 lb	3.85	4.35	6.00	3.35	3.52½	4.80	4.25	+4.00	6.50
Reinforcing bars, ¾ in. up, 100 lb	2.94	3.50	3.50	2.82½	2.95	3.97½	3.00	+3.75	+3.25
Steel pipe, black, 2½ to 6 in. lap, discount	57%	61.15%	45%	59½%	58.9-5%	43%	45.7@49.1%	+45%	30.00
Cast-iron pipe, 6 in. and over, ton	55.30	—49.00	51.50	46.86	52.00	60.00	51.00	—51.00	50.00
Concreting Material:									
Cement without bags, bbl	2.85@3.00	2.50	2.25	2.20	2.39	2.85	2.71	2.90	2.78
Gravel, ¾ in., cu.yd	1.75	1.85	2.25	2.00	1.75	1.75	2.25	1.00	1.50
Sand, cu.yd	1.00	1.15	2.25	2.00	1.00	0.75	1.50	1.00	1.25
Crushed stone, ¾ in., cu.yd	1.75	1.90	1.65	1.60	2.25	3.50	2.25	3.00	—1.90
Miscellaneous:									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft	+57.00	40.00	40.00	49.00	40.00	50.00	33.00	24.50	50.00
Lime, finishing, hydrated, ton	15.80@16.17	+23.00	25.00	18.00	29.00	24.00	22.00	24.00	21.00
Lime common, lump, per bbl	2.75@3.14½	+1.80	2.50	1.40	1.40	2.70	1.75	2.80	11.00
Common brick, delivered, 1,000	—18.00@20.20	+12.00	10.90	11.00	18@19	12.00	15.00	14.00	16.00
Hollow building tile, 4x12x12, per block	Not used	.0776	.115	.1101	.09	.065	....	.11	.08
Hollow partition tile 4x12x12, per block	.1112	.0776	.115	.0808	....	.065	.108	.11	....
Linseed oil, raw, 5 bbl. lots, gal	.91	+.99	1.13	—.97	1.00	1.12	1.04	.86	1.12
Common Labor:									
Common labor, union, hour	.60	.35	.....	.80	.....	.50@.55	.56¼	.50@.60	.....
Common labor, non-union, hour	.44@.60	.30	.25	.72½	.35@.50	.35@.50	.47½@.50	....	.30@.35

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given: 45-5% means a discount of 45 and 5 per cent. Charge is 15c. per 100 lb. for cutting reinforced steel into 2-ft. lengths or over.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net, and hydrated lime f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b. Cement and concrete laborers' rate, 81½c.; pick and shovel men, 60c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; common lump lime per 180-lb. net. Lumber delivered on job.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.70 for Kelly Island and $1.55 for Sheboygan. Common labor not organized.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered, in wooden bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on Douglas fir instead of pine. Sand, stone, gravel and lump lime per ton. Cement, lime and tile are delivered; sand, gravel and stone on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 99.96 cents. Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 2½-in., $30; 6-in., $110.

Changes Since Last Week

Structural shapes and reinforcing bars, $2@$2.10 per 100 lb., f.o.b. Pittsburgh, on ordinary business; $2.15@$2.25 for prompt shipments. Standard rails quoted by leading interest at $43, as against $40 per ton, at mill. The new price, effective Oct. 1, represents the first rise in standard rails since October, 1921, when the price dropped from $47 to $40 per ton. Steel ingot production at Pittsburgh mills has jumped from an annual rate of 26,000,000 to 30,000,000 tons in the last three weeks, despite the continued scarcity of coke and pig iron. Car shortage, or still more strictly speaking locomotive shortage, may prevent further gains in output for some time to come. The closing of the Ford motor plant, however, will have a lessening effect upon demand to the extent of about 30,000 tons of iron and steel per month.

Seattle warehouses quote shapes at $3.90 as against $3.75; rivets at $4, up from $3.75, and reinforcing bars at $3.75, compared with $3.60 per 100 lb. last week. Montreal also reports advance in steel bars, now $3.25 as against $2.90 per 100 lb. Steel pipe discounts in Seattle warehouses reduced five points, following recent mill advance.

With lumber production at 5 per cent below normal for the week ending Sept. 9 as compared with a normal rate of output attained during the week of Aug. 26, and orders and shipments also rapidly falling below normal, lumber prices in New York advanced $2 per M ft. over the week end. Although no other large centers reported advances, lumber prices are firmer if not higher throughout the country.

Atlanta reports hydrated lime up 50c. per ton and common lump, 5c. per bbl.; also a rise of $1 per M on common brick. New York, however, quotes brick at $18@$20.20, as against $21.30 per M, delivered, one week ago.

Linseed oil up 4c. in New York and down 2c. per gal. (5 bbl. lots) in Chicago, since last week.

Reduction in prices of 40@60 per cent gelatin dynamite are announced, effective Sept. 18.